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STUDY OF CARCINOMA STOMACH

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MADURAI MEDICAL COLLEGE

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CERTIFICATE

This is to certify that this dissertation entitled **"A STUDY ON CARCINOMA OF THE STOMACH"** is bonafide work done by **Dr. S. Lakshmi Bai** under our guidance and supervision in the Department of surgery, Madurai Medical College, Madurai submitted for the M.S.,(General surgery) BRANCH I EXAMINATION, to be held in March 2008, by the Tamilnadu DR.M.G.R. Medical university, Chennai.

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INTRODUCTION

Historical background

The first account on cancer of stomach was given by Avicenna as early as 1037. The first detailed paper on malignant lesions of stomach was given by Morgagni in 1761. Pean in 1879 did the first gastric resection for cancer. In 1881, Billroth performed the first successful pyloric resection. Schlatter in 1897 performed the first total gastrectomy. In 1906, Cuneo gave the first detailed description of lymphatic drainage of stomach. Polya in 1911 advocated partial gastrectomy for distal stomach cancers. McNeer in 1951 recommended more radical surgeries for carcinoma stomach as there was increased incidence of local recurrence in the stomach bed of patients who died of gastric cancer following surgery.

AIM OF STUDY

The aim of this study is to determine retrospectively changes in the incidence with relation to age, sex and site-specific distribution of gastric malignancy and a comparison of the study with the western literature.

The period of study was between June 2005 and May 2007 in Government Rajaji Hospital, Madurai.

LITERATURE REVIEW

Gastric malignancy is the second most common cause of cancer-related deaths worldwide.

Gastric cancer has a wide geographic variation. Countries in Asia with a high incidence include Japan, China, and South Korea; those with a low incidence include India, Pakistan, and Thailand.

Major changes have been noted in the site of gastric cancer occurrence. The West has noted a paradigm shift with a steady increase being observed in the incidence of cancers of the gastric cardia and the proximal stomach and a decline in the distal stomach. The redistribution has been attributed to the reduction in *H. pylori* infection and the associated atrophic gastritis. Reports from Asian countries like Japan, Korea and Iran have been conflicting. The Japanese and the Korean populations have a predominance of distal gastric cancers while the Iranians have reported a trend similar to that in the West. A recent study from Kerala showed that carcinoma of the distal stomach has remained predominant although a trend towards a proximal shift has been noted (1). Incidence rates in men are twice those in women (2).

The most striking observation was for the tumours of lower end of oesophagus and oesophagogastric junction which constituted 14% of the total oesophagogastric cancers in 1984-1988 rising to 24% in (1994-1998). This

increase was primarily because of an increase in the number of endoscopies and diagnosis of adenocarinomas at the lower end of oesophagus and gastrooesophageal junction.

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MATERIALS AND METHODS

The study period was from June 2005 to May 2007 in Government Rajaji Hospital in the Surgical Department, Surgical Gastroenterology department, Medical Gastroenterology department and Medical Oncology department for the analysis of the changes in trend for site specificity, age and gender predilection.

Details of 303 patients with adenocarcinoma of the stomach were retrieved. Cancer recurrence after surgery and also those cancers that occurred after gastrojejunostomy for peptic ulcer disease were excluded. Age, gender, clinical presentation and duration of illness were recorded in a prestructured proforma. The site of the stomach tumor was recognized as involving one of the four sites, namely:

a. OGJ (tumour arising from esophagogastric junction)

b. Proximal stomach involving the cardia and or fundus

c. Body

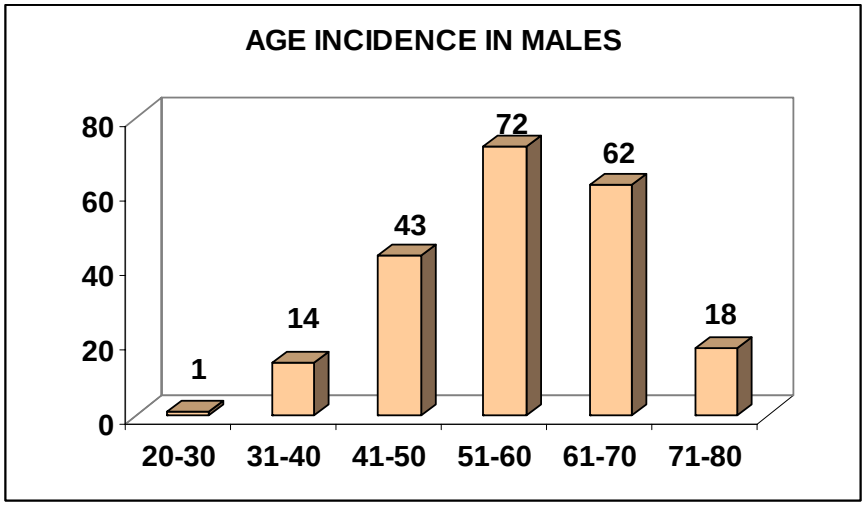
d. Antrum

RESULTS OF STUDY

- The peak incidence of gastric cancer was during the sixth decade.
- Male gender were more commonly affected.
- The antrum was the most common site of malignancy.

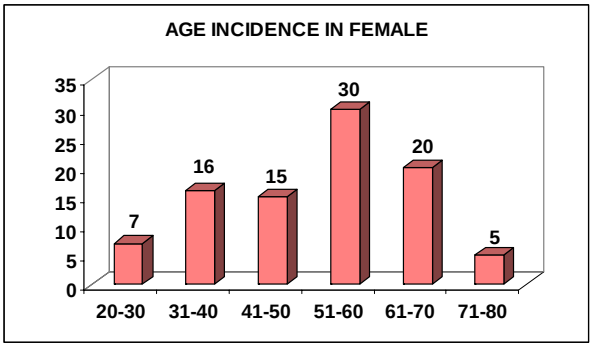
AGE INCIDENCE – MALE

Age Group	Male
20-30	1
31-40	14
41-50	43
51-60	72
61-70	62
71-80	18



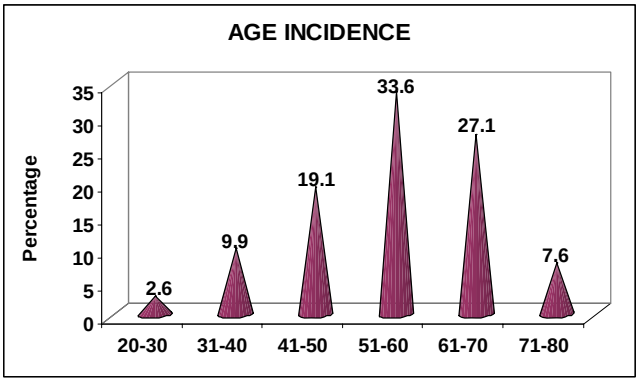
AGE INCIDENCE IN FEMALE

Age Group	Female
20-30	7
31-40	16
41-50	15
51-60	30
61-70	20
71-80	5



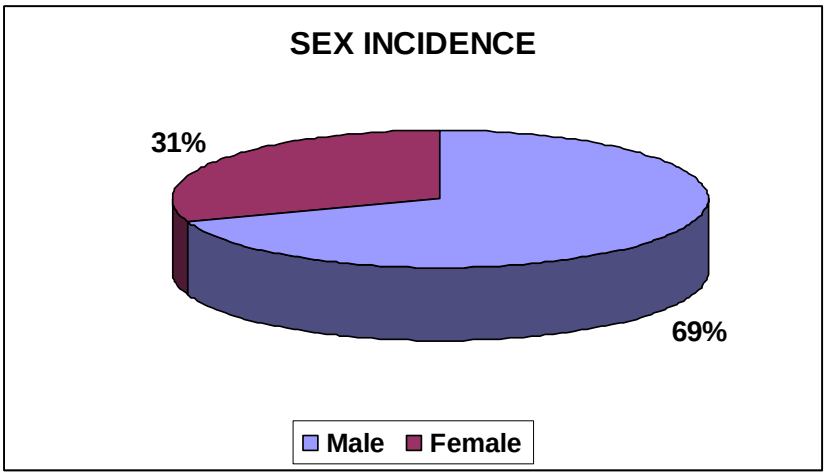
AGE INCIDENCE

Age Group	Male	Female	Total	Percentage
20-30	1	7	8	2.6
31-40	14	16	30	9.9
41-50	43	15	58	19.1
51-60	72	30	102	33.6
61-70	62	20	82	27.1
71-80	18	5	23	7.6



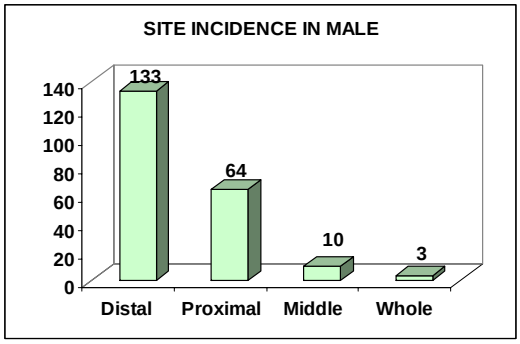
SEX INCIDENCE

Male	Female
210	93



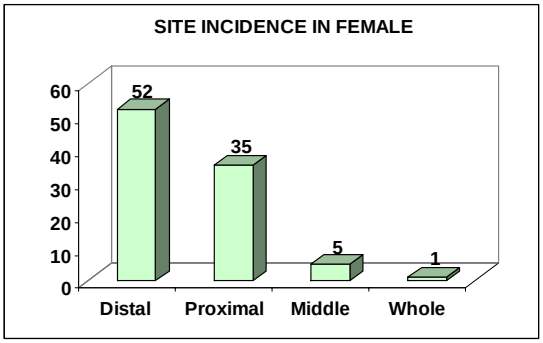
SITE INCIDENCE IN MALE

SITE	NUMBER
Distal	133
Proximal	64
Middle	10
Whole	3



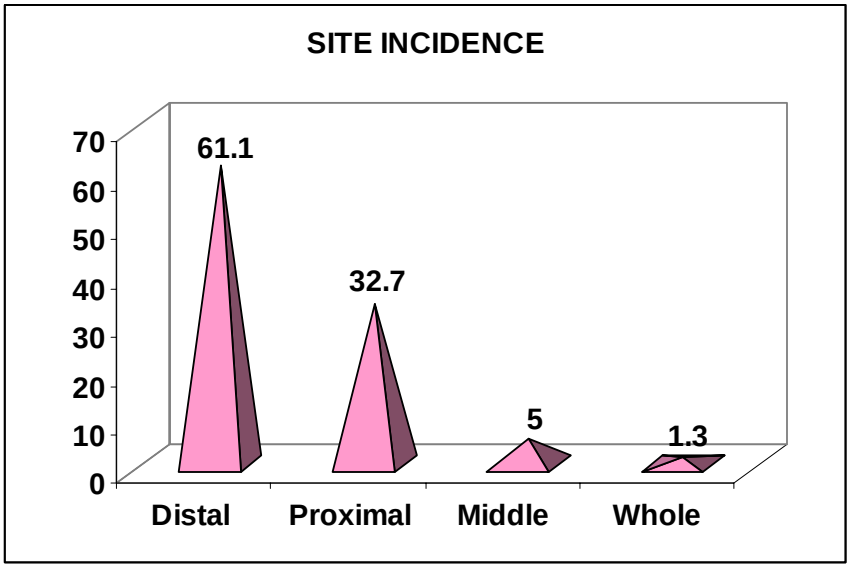
SITE INCIDENCE IN FEMALE

SITE	NUMBER
Distal	52
Proximal	35
Middle	5
Whole	1



SITE INCIDENCE

Site	Male	Female	Total	Percentage
Distal	133	52	185	61.1
Proximal	64	35	99	32.7
Middle	10	5	15	5
Whole	3	1	4	1.3



SURGICAL ANATOMY

The stomach is the most dilated part of the alimentary canal and is situated between the oesophagus and the duodenum and it develops from the foregut. It lies in the epigastric, umbilical, and left hypochondriac areas of the abdomen. Generally it is 'J' shaped organ and is flat when collapsed. Its shape, size and position are highly variable. Its shape and position are modified by changes within itself and by the surrounding viscera.

It has two openings, two curvatures and two surfaces.

ORIFICES OF THE STOMACH - Cardiac & pyloric ends

The lower end of the oesophagus joins the cardiac orifice. It lies under diaphragm usually to the left of the midline at the level of T10 vertebra. Oesophago gastric junction is 40 cm from incisor teeth.

Pyloric orifice opens into the duodenum. It lies ½ inch to the right of median plane at the level of lower border of L1 vertebra (Transpyloric plane) in supine position.

TWO CURVATURES

Lesser curvature is concave and forms the right superior border of the stomach. It provides attachment to the lesser omentum. The most dependant part (junction of horizontal & vertical part of curvature) is the angular notch or incisura angularis.

Greater curvature is convex and forms the left inferior border of the stomach. Greater curvature is directed antero inferiorly and is four or five times greater than lesser curvature. It starts from the cardiac incisura and arches upwards postero laterally and to the left. Its highest convexity, the fundus is level with left fifth inter costal space just below the nipple in males, though varying with respiration. Opposite the incisura angularis of the lesser curvature, the greater curvature presents a bulge, taken as the limit of the pyloric part of the stomach. Its right limits being a slight groove indicating subdivision into the pyloric antrum and canal.

PARTS OF THE STOMACH

The main parts of the stomach are fundus, body and pylorus. Fundus of the stomach is the convex dome situated above the level of cardiac orifice and is commonly distended with gas and in contact with left dome of diaphragm.

Body of the stomach lies between fundus and pyloric antrum.

The pyloric part extends from the angular notch to the gastro duodenal junction and consists of the proximal pyloric antrum, which narrows distally as the pyloric canal followed by the pyloric sphincter. Pyloric canal is about one inch long, being narrow and tubular. Pyloric antrum is separated from the pyloric canal by an inconstant sulcus intermedius on the greater curvature. The pyloroduodenal junction is identified by the presence of prepyloric vein of Mayo.

TWO SURFACES – Anterosuperior & Posteroinferior

DIMENSIONS OF THE STOMACH

Stomach is a distensible organ. It is about 25 cm long in adults. Its mean capacity is about 30 ml at birth and 1 L at puberty and about 2 L or more in adults.

RELATIONS OF THE STOMACH

PERITONEAL RELATIONS

The stomach is completely invested by peritoneum which passes in a double layer from lesser curvature to liver as the Lesser omentum and hangs down from the fundus & Greater curvature as the Greater omentum.. Near the fundus the peritoneal layers meet to form the gastrosplenic ligament which contains the short gastric vessels. The bare area of the stomach is a small triangular area on the posterior surface close to the cardiac orifice which is in direct contact with the left crus of the diaphragm.

VISCERAL RELATIONS

Anterior surface of the stomach is related to liver in the right, diaphragm in the left, and to anterior abdominal wall between the two.

Posterior surface is in relation with diaphragm, left suprarenal gland, left kidney, splenic artery, body of pancreas, transverse mesocolon and left colic flexure. These structures form the stomach bed and are separated from the stomach by the

lesser sac. Spleen also forms stomach bed, but is separated from stomach by Greater sac.

Surgical access to the lesser sac can be obtained by creating a window in the lesser omentum, transverse mesocolon, or gastro colic portion of the greater omentum. Although lesser omentum is less vascular and close to the stomach, generous access to the lesser sac is prevented by structures in the free border of lesser omentum (Common bile duct, portal vein and hepatic artery).

The middle colic artery limits exposure through mesocolon. When it is necessary to create a window, as for example, for posterior gastro jejunostomy, it is usually best to divide the mesocolon to the left of the middle colic vessels.

Arterial supply

1. The left gastric artery: This arises from celiac axis, and divides into an ascending branch and descending branch. The descending branch, lying between the layers of the lesser omentum is closely opposed to the lesser curvature and sends branches to the stomach.
2. The right gastric artery: arising from the common hepatic artery also divides into a number of branches to supply stomach along the lesser curvature and finally anastomosis with left gastric artery.

3. The right gastro epiploic artery, branch of the gastro duodenal artery which runs from right to left along the greater curvature to anastomose with the left gastro epiploic artery.
4. The left gastroepiploic artery: A branch of splenic artery contributes to the arterial arcade along the greater curvature.
5. 5to 7 small branches from the splenic artery supplies the fundus. (Short gastric arteries)
6. The left inferior phrenic artery supplies a small area around the fundus.
7. Oseophagus has a rich intramural arterial anastomosis in its sub mucosal layer, which is continuous with a network in submucosa of stomach. This explains how, following a near total gastrectomy an upper gastric remnant retains its blood supply.

   Blood supply to the greater omentum comes from the right and left gastric epiploic arteries which forms an arcade along the greater curvature of the stomach. The right epiploic artery (from right gastro epiploic artery) and left epiploic artery (from left gastro epiploic artery) form an anastomotic arcade in the lower part of the omentum which is joined by accessory epiploic arteries (from the two gastro epiploic arteries) and provide a rich blood supply to the omentum. When mobilizing greater omentum from the stomach, it is therefore not necessary to preserve the gastro epiploic arcade provided epiploic arcade is preserved.

Venous Drainage

These commence as straight vessels between the mucosal glands and drain into the sub mucosal veins. Larger veins accompany main arteries and drain into splenic and superior mesenteric vein and portal vein. Left gastric vein (Coronary vein) receives branches from esophagus and is a site for portosystemic anastomosis.

Applied anatomy

- The stomach has got a rich blood supply and hence the stomach remains viable after ligation of all arteries except one
  - Right Gastroepiploic Artery & perhaps Right Gastric Artery.
- Sub mucosa is the most vascular layer
  - Ligation of most or all extrinsic arteries doesn't control ulcer bleeding completely
- Venous drainage to Portal vein
  - First filter is liver and is the most common site for metastasis

LYMPHATIC DRAINAGE

Lymph vessels of the stomach are situated along the following sites.

1. sub mucosal plexus (communicates with lymphatics of esophagus)
2. intra mural plexus
3. sub serosal plexus (communicates with lymphatics of duodenum)

They anastomose freely with each other. This network drains into the large lymphatic vessels which accompany the four main vessels to the greater and lesser curvature. The sub mucosal lymphatics of the stomach and lower oesophagus communicate freely, facilitating the spread of carcinoma from one organ to another. The lymphatics of the antrum drain into the right gastric node superiorly, and right gastro epiploic and sub pyloric node inferiorly.

The lymphatics of the pylorus drains into supra pyloric node superiorly and sub pyloric nodes situated along the gastro duodenal artery
inferiorly.

The efferent lymphatics from the supra pyloric lymph nodes converge on the para aortic nodes around the celiac axis, while the efferent lymphatics from the sub pyloric lymph nodes passes onto the superior mesenteric nodes situated along the origin of superior mesenteric artery.

The Japanese research society for gastic cancer has assigned a number to each lymph node station to aid the pathological staging.

The differentiation between a D1 and a D2 operation depends upon the tiers of nodes removed. Different tiers need to be removed depending upon the position of primary tumour. In general, a D1 resection involves the removal of perigastric nodes and D2 resection involves D1 resection and the clearance of lymph nodes along the major arterial trunks. There remains some controversy about the extent of lymphadenectomy required for the optimal management of

curable gastric cancer. In Japan, atleast a D2 gastrectomy is performed for all operable gastric cancer, whether or not there is histological evidence of regional lymph node involvement. Retrograde spread may occur if the upper lymphatics are blocked. In Japan, the lymph node dissection is highly advanced.

NERVE SUPPLY

Sympathetic supply :

The sympathetic nerves are derived from T6 to T10 segments of spinal cord via the Greater splanchnic nerves, celiac & hepatic plexuses. They travel along arteries supplying the stomach. These nerves are vasomotor, motor to pyloric sphincter, but inhibitory to the rest of gastric musculatrure & carries pain sensation from the stomach.

Parasympathetic supply:

Parasympathetic supply is from the vagus nerves. They are secretomotor to gastric mucosa and motor to gastric musculature. It is responsible for co-ordinated relaxation of pyloric sphincter during gastric emptying. Usually one or two rami branch on the anterior and posterior aspects of the gastro-oesophageal junction. The anterior gastric nerves are mostly from the left vagus and posterior from the right vagus, both emerging from the oesophageal plexus. The anterior nerves supply filaments to the cardiac orifice and divide near the oesophageal end of the lesser curvature into gastric, pyloric and hepatic branches.

The Gastric branches (4-10) radiate on the anterior surface of the body and fundus: one, larger than the others, lies in the lesser omentum near the lesser curvature.

The pyloric branches, generally two, the smaller one traverses the lesser omentum almost horizontally to the right, towards its free edge, then turns down on the left side of the hepatic artery to reach the pylorus. The larger one, usually arising from the greater anterior gastric nerve, passes obliquely to the pyloric antrum. Hepatic branches (one or two) originate from the pyloric branches and contribute to hepatic plexus.

The nerve, which runs about 10-15 mm above the lesser curvature and supplies the acid and pepsin secreting part of the stomach is called the Nerve of Latarjet.

The posterior nerves are divided into two groups - gastric and celiac. Gastric branches radiate over the posterior surface of the body and fundus and extend to the pyloric antrum but do not reach the pyloric sphincter. The largest one passes posteriorly along the lesser curvature, giving branches to the celiac plexus. Coeliac branches, larger than the gastric, pass in the lesser omentum to reach the celiac plexus.

Near the Gastro oesophageal junction, the posterior gastric nerve gives rise to the Nerve of Grassi. It supplies the fundus of the stomach.

HISTOLOGY OF THE STOMACH

a. Serosal layer

Outer most layer of the stomach, completely invested by the peritoneum except along the greater and lesser curvature and also upper posterior surface of the stomach near the cardiac orifice.

b. Muscular layer:

Muscles of the stomach are arranged into following layers. 1. Outer longitudinal 2. Intermediate circular and 3. Inner oblique

c. **Sub mucosal layer**:

The sub mucosal layer has only loose connective tissue, blood vessels and nerve plexus (Meissner's plexus). This part of the stomach is the strongest layer.

d. Mucosa:

In an empty stomach, it is thrown into folds called gastric rugae, which are flattened in a distended stomach. The rugae along the lesser curvature are longitudinal and forms gastric canal of Maganstrasse.

When viewed microscopically at low magnification the internal surface of the stomach wall appears honey combed by small somewhat irregular gastric pits. The base of each gastric pit receives several long tubular gastric glands, which extend deep into the lamina propria as far as muscularis mucosa. Simple columnar mucus secreting epithelium covers the entire luminal surface including

the gastric pits composed of a continuous layer of surface mucous cells which liberate gastric mucus from their apices to form a thick protective, lubricant layer over the gastric lining.

Gastric glands :

Although all are tubular, they vary in form and cellular composition in different parts of the stomach. They can be divided into the following categories.

1. Cardiac
2. Principal (in the body and fundus)
3. Pyloric

1. Cardiac glands

These are confined to a small area near the cardiac orifice. Mucus secreting cells predominate. Parietal and zymogenic cells are present but few in number.

2. Principal glands

These are found in the body and fundus. Three to seven glands open into each gastric pit. Their confluence with the base of the pit is termed the isthmus of the gland and immediately basal to this, is the neck, the remainder being the base. In the wall of the gland, there are atleast five distinct cell types: Chief, parietal, mucous neck, stem, and enteroendocrine (neuroendocrine) cells.

(i) Chief cells:

They are the source of digestive enzymes - pepsin and renin. They are usually basal in position, their shape being cuboidal and their nuclei rounded and euchromatic. They contain zymogen granules and are strongly basophilic.

(ii) Parietal (Oxyntic) cells:

These cells are the sources of gastric acid and intrinsic factor (which is necessary for absorption of Vitamin B12). They are large, oval and strongly eosinophilic, with centrally placed nuclei and are mainly situated in the more apical half of the gland reaching as far as the isthmus.

(iii) Mucous neck cells:

These cells are numerous at the neck of the glands, and also scattered along the walls of the more basal regions. They are typical mucus secreting cells.

(iv)Stem cells:

These cells are relatively undifferentiated mitotic cells from which the others types of gland cell are derived. They are situated in the isthmus region of the gland and base of the gastric pits.

(v) Enteroendocrine cells:

These cells occur in all types of the gastric gland but more frequently in the body and fundus. They are situated mainly in the deeper parts of the glands among the chief cells. They include cells named as G cells secreting Gastrin, D cells secreting somatostatin, ECL (**E**ntero**c**hromaffin **l**ike cells) secreting histamine.

3. Pyloric glands:

Pyloric glands are mostly furnished with mucus secreting cells, parietal cells being few and chief cells mainly absent. Enteroendocrine cells are numerous.

Lamina propria:

Found between the glands, this forms a connective tissue framework and contains lymphoid tissue which especially in early life collects in small masses termed gastric lymphatic follicles resembling solitary intestinal follicles.

Muscularis mucosa:

This is a thin stratum of smooth muscle fibers lying external to the layer of the glands.

PHYSIOLOGY

Functions of the stomach

1. Storage:

The function of the stomach is to act as a reservoir for ingested food. The main function of the stomach is to mix and churn the food so that it is delivered

slowly to the duodenum. Swallowed food enters the stomach where it is mixed with gastric juice and changed to a more liquid form. The storage function of the stomach is mainly performed by receptive relaxation. The upper portion of the stomach relaxes as the intake of food is anticipated. Food particles are reduced in size by the grinding action of the antrum. Pylorus constantly returns ingested material to the proximal stomach to be churned repeatedly until and unless it is ready for delivery to the duodenum.

2. Digestion:

Small amount of digestion takes place in the stomach, mostly proteolysis. Pepsin, the proteolytic enzyme of the stomach is active in acid environment (pH below 5). It also secretes mucus, which prevents auto digestion of the stomach. The liquefied, churned food which has undergone slightly proteolysis is then delivered slowly into the duodenum. The mixing and slow emptying of the mixed meal from the stomach is performed by antral pump. Contraction of the body of the stomach propels contents into the gastric antrum. As the antrum fills, the pylorus opens to allow the escape of some chime. When contraction wave reaches the pylorus it closes. The antral contents are now pushed back into the body of the stomach. Thus each contraction wave produces both the escape of a small quantity of chime and mixing of the remainder. The amount of chime passed through the pylorus with each contraction will depend upon the viscosity

and amount of solid in the gastric contents. Fluids are emptied more rapidly. Starches undergo enzymatic breakdown by low pH, which is favourable for the activity of salivary alpha-amylase. Peptic digestion of fats, proteins and carbohydrates takes place by breaking down cell walls. Gastric mucosa also secretes a lipase which assists in the early stage of fat digestion.

3. Haematopoiesis:

It produces intrinsic factor (by the parietal cells) which is essential for absorption of vitamin B12 and thus helps in haematopoiesis.

4. Anti microbial:

Majority of the bacteria die due to the low gastric PH. Only a few unusual fusiform bacilli can withstand the gastric acid.

5.Defence mechanism:

Gastric mucosa has got the capacity to protect its surface from harmful ingestants. Rapid mucus release is the first line of defense. If potentially dangerous material permeate through the mucosa, the lamina propria stands in the way with the army of mast cells, macrophages and lymphocytes.

6.Heat exchange:

The stomach, due to its abundant mucosal microcirculation, can act as heat exchanger. Due to this mechanism a stable thermal environment is maintained against too cool or warm ingestant. This offers protection to the

adjacent viscera against thermal damage. Stimulation of secretion occurs in three phases.

1. Cephalic phase in which the secretion is stimulated by thinking about food.
2. Gastric phase in which the secretion is stimulated by presence of food in the stomach.
3. In the intestinal phase, the presence of chime in the duodenum and small bowel inhibits gastric emptying and the acidification of duodenum leads to production of Secretin, which also inhibits gastric acid secretion, along with numerous other peptides originating from the gut.

INCIDENCE & EPIDEMIOLOGY

There are marked variations in the incidence of gastric cancer worldwide.

- Worldwide, gastric adenocarcinoma is the second most common cancer (second to lung cancer). The highest incidence (>30 cases per 100,000 population) is in Japan, Russia, China, South America, and Eastern

Europe. Carcinoma of the stomach is called the ‘National Disease’ of Japan. The lowest incidence (<3.7 cases per 100,000 population) is in North America, Western Europe, Australia, and New Zealand.

- In the US, the incidence decreased from 33 cases per 100,000 population in 1930 to 3.7 cases per 100,000 population in 1990. The incidence of carcinoma of the cardia has increased rapidly in the last 20 years, in contrast to the decline in gastric cancer as a whole, particularly in tumors of the body and antrum. In US and UK, there is a decline in the incidence of gastric malignancy.

There is a rising trend in the number of stomach malignancies in southern and eastern parts of India. In Mizoram, one of the north-eastern state of India, high incidence of stomach cancer is recorded.

HELICOBACTER PYLORI AND GASTRIC CANCER

It is interesting to note that despite Japan being a developed country with a lower frequency of *H pylori* infection, it has highest frequency of gastric cancer. Similarly, frequency of gastric cancer is quite high in China despite a lower frequency of *H pylori* infection. In contrast, people living in less developed countries of Asia with high frequency of *H pylori* infection that is acquired at an earlier age have the lowest risk of developing gastric cancer. It has also been

observed that frequency of gastric cancer differs in different parts within many countries; for example, in Japan, variation in gastric cancer risk has been well-documented in different regions and has been presumed to be related to variation in nutrient consumption. In China, gastric cancer mortality in Changle county is about 10-fold higher than that in Hong Kong and has been attributed to variation in frequency of *H pylori* infection in the two regions. In India, southern and eastern parts of the country experience somewhat higher frequency of gastric cancer than the northern parts of the country.

Race:

Overall, gastric carcinoma is 1.5-2.5 times more common in African Americans, Hispanics, and American Indians than in whites. The incidence of gastric carcinoma in Japanese/ Chinese migrants in United states continues to be three to six times higher than that of US- born whites, with the highest rates occurring in those, born in Japan. The incidence of adenocarcinoma of the cardia is highest among white men. Carcinoma stomach is the commonest cancer among males in the southern parts of India. Most of the patients present at an advanced stage in India. Carcinoma stomach accounts for about 52 % of deaths due to malignancy in males and about 38 % in females. The prominent change in the epidemiology of gastric carcinoma has been that excluding tumours of the cardia, the overall survival rate has increased due to (a) increase in the proportion

of patients with early gastric cancer: (b) decrease in the proportion of patients in stage IV disease and (c) an increase in the resectability rate, a rise in the proportion of radical gastrectomies.

Age:

Carcinoma stomach is more common between 50 – 70 years. Peak age of incidence is around 60 years for both sexes. It is rare among people who are less than 30 yrs old. Intestinal type of cancer is more common in antrum and particularly in elderly age group.

Sex:

Gastric carcinoma is more common in men than in women. Conflicting reports have been received so far as sex involvement is concerned. In few reports males are more often affected than the females, whereas in a few reports the sex incidence has been quoted as equal. The usual high incidence in males is probably due to increased association with smoking and alcohol consumption when compared to females. In our study, out of 303 cases, the male to female ratio is 2.3: 1, 210 being male and 93 females. The most common Histopathological type of malignancy in our study was poorly differentiated adeno carcinoma.

SITE INCIDENCE

In U.K. there is an increase in incidence of upper one third stomach malignancies (a rise from 17 % to 39 %). In Japan again there is a proximal shift in incidence of stomach cancer (from 10 to 40 %). In our study, there is no such proximal shift. Antral and prepyloric tumors continue to be the most common site of malignancy followed by body and fundus. Fundal malignancies are more aggressive because of the following reasons:

a. Thin muscularis mucosa
b. Tightly packed glands that blocks lateral growth
c. Signet ring carcinoma is more common
d. Worse prognosis
e. Advanced stage at presentation

AETIOLOGY OF CARCINOMA STOMACH

Genetic and Familial factors:

There is clear evidence of clustering of carcinoma of stomach in families. The famous example being the Bonapartes – Napoleon, his father, grandfather, brother and three sisters died of gastric carcinoma.

About 4 % of patients have a positive family history.

There is some evidence of association of blood group A with carcinoma stomach – the relative risk over blood group O being 1.2 times. This is because of (a) the nature of mucopolysaccharide secretion in stomach (b) increased susceptibility to ingested carcinogen. Diffuse type of malignancy is more common in such patients.

Genetic Abnormalities in Gastric Cancer

Abnormalities	Gene	Approximate frequency (%)
Deletion / suppression	P 53	60-70
	FHIT	60
	Apc	50
	Dcc	50
	E-cadherin	<5
Amplification/ overexpression	COX-2	70
	HGF/SF	60
	VEGF	50
	c-met	45
	AIB – 1	40
	β - catenin	25
	k – sam	20
	ras	10-15
	c-erb B-2	5-7
Microsatellite instability		25-40
DNA aneuploidy		60-75

Environmental & Dietary factors:

High risk food

A diet poor in milk, animal protein, vitamins, antioxidants but rich in starch, use of heavily salted pickles, smoked fish and meat (which contain polycyclic hydrocarbons – benzopyrene – carcinogen). In U.S. there is a decline in the incidence of carcinoma stomach because of improved techniques of food preservation by refrigeration rather than smoking or salting. The nitrates, nitrites present in protein diet, food preservatives, water and soil are converted by the gastrointestinal bacterial flora to Nitrosamines (N-Nitroso compounds) which are carcinogenic. Atrophic gastritis and Achlorhydric stomach predispose to production of N-Nitroso carcinogen.

Defects in mucosal barrier facilitates penetration of carcinogens.

Spirits, Japanese Saki, contaminated whisky, smoking (30 cigarettes per day) predispose to gastric cancer.

Elevated levels of zinc, lead in drinking water can predispose to gastric cancer.

Talc and asbestos may be additional environmental factors.

Socioeconomic Status

Carcinoma of the antrum and body of the stomach is most common in the lower socio economic groups, whereas the increase in proximal gastric cancer seems to occur in higher socio economic groups.

Occupational Factors

Groups of workers, which have been shown to be at high risk, include metal industry workers, painters, printers, fisherman and Ceramic and clay workers. In our series most of our patients were coolie workers only.

PREMALIGNANT CONDITIONS

1. **Chronic atrophic gastritis and intestinal metaplasia:**

   Patients with hypogammaglobulinemia and pernicious anaemia have chronic atrophic gastritis and incidence of gastric cancer is said to be higher.

   There are two types of Chronic Atrophic Gastritis – Type A & Type B.

   Type A is associated with pernicious anaemia and cancer occurs commonly in fundus and body which is autoimmune in origin.

   Type B gastritis leads to carcinoma of gastric antrum and is related to environmental factors. It is also found in patients who had undergone gastrectomy for benign peptic ulcer disease.

   The first lesion is atrophic gastritis which leads to achlorhydria and progressive intestinalization of mucosa to metaplasia, dysplasia and finally cancer.

2. **Role of Helicobacter pylori infection**

   Recently gastric cancer has been associated with H. pylori infection particularly the cag – A strain. The organism is associated with antral inflammation and gastritis. It is proposed that infection and inflammation

may result in the production of epidermal growth factors, which may have an oncogenic action on gastric musosa. Intestinal type of cancer is common in such patients.

H pylori alone is not the only independent factor in gastric carcinogenesis. Host's genetic make-up and dietary factors play a major role in determining whether or not a person infected with *H pylori* will develop gastric atrophy, intestinal metaplasia and gastric cancer. This has major importance in preventive strategies of gastric cancer. Despite *H pylori* being an important agent for causing gastric cancer, a recent randomized controlled trial from high risk region of gastric cancer in China failed to show benefit of eradicating *H pylori* in preventing gastric cancer. This might be related to the fact that only 1-2% people infected with *H pylori* develop atrophic gastritis per year, which is a precancerous lesion. Racial and genetic factors are also important as evidenced by difference in gastric cancer risk in different populations, and a recent study, though not from Asia, showed differences in IgG subclass responses between subjects from Gambia and United Kingdom with *H pylori* but also carry multiple genetic factors which increase their predisposition to developing gastric carcinoma.

3. Gastric polyps

a. Most are hyper plastic polyps that are regenerative, non- neoplastic, multiple lesion and distributed throughout the stomach and usually smaller than 2 cm. They can undergo spontaneous regression.

b. Adenomatous polyps : They occur in antrum commonly and are more than 2 cm in size and have highest risk (50 – 66%)of malignant transformation. They are subclassified into sessile, pedunculated and villous types.

4. Previous gastric surgery

As early as 1922, Balfour reported a gastric cancer occurring in the residual stomach after surgery for benign peptic ulcer disease. The term stump cancer was soon used since carcinoma seemed to occur more frequently after Billroth I and II gastrectemy than after Vagotomy with pyloroplasty or gastroentrostomy.

4. Hypertrophic gastropathy (Menetrier's disease)

In which there is giant hypertrophy of fundic mucosa with cystic changes in the crypts. Gastric cancer has been reported to occur in such patients in approximately 10% of cases. Pathogenesis is related to development of atrophic gastritis and achlorhydria secondary to duodenogastric bile reflux.

5. Gastric dysplasia

This dysplasia may be mild, moderate, or severe. Type A dysplasia is of environment related variety, which occurs following intestinal metaplasia.

Type B dysplasia is more associated with the diffuse type of gastric cancer. The progression of normal gastric epithelium through various stages resulting finally in an invasive cancer takes several years.

PATHOLOGY OF CARCINOMA STOMACH

Gastric adeno carcinoma mostly develops from mucous cells anywhere within the stomach, although the majority develops in the pyloric and antral regions, particularly, along the lesser curvature. Fundal carcinoma and Carcinoma at the oesophago gastric junction constitute about 10% to 15% of all

gastric cancers. When carcinoma follows pernicious anaemia, it is more likely to be fundal.

Macroscopically carcinoma stomach can be divided into five types.

1. **Ulcerative:** Ulcerative carcinoma of the stomach is the most malignant type. These growths occur most frequently in the pyloric segment or in the region of the lesser curvature though no portion of the stomach is immune. The ulcer is usually oval or circular in shape and has a firm, raised and rolled out edge, the floor of which is often necrotic.
2. **Proliferative Type:** This forms bulky cauliflower like masses, which project into the lumen of the stomach. These usually arise in the region of body of the stomach, posterior wall and fundus. These are prone to become infected and to ulcerate. When these complications develop these tumours may bleed and the effects of bleeding becomes the striking feature. These growths are usually Adenocarcinomas and are composed of columnar epithelial cells.
3. **Linitis plastica:** The local form of the disease starts at the pylorus and spreads slowly in the direction of the cardia and is associated with much fibrosis. Two varieties are usually seen

Localized variety, which usually involves the pyloric region Diffuse form which usually starts at the pyloric region infiltrating the submucosa growing slowly around the circumference and along the longitudinal axis of the

stomach towards the cardia. The stomach eventually becomes shortened and contracted, and is transformed into a leathery rigid tube incapable of being distended. So this is called leather bottle stomach.

4. **Colloid carcinoma** is merely a gelatinous degeneration of one of the above varieties.
5. **Ulcer turning to malignancy:** Most authorities agree that in a certain proportion of cases, cancer arises in a chronic gastric ulcer. A chronic ulcer situated on or with in ½ an inch of the greater curvature should be regarded and treated as malignant. Large indolent ulcers occurring on the posterior wall away from the curvatures show malignant changes in 10% cases.

The classifications available for gastric carcinoma are

1. Stout 2. Lauren 3. Ming 4. Bormann 5. Japanese 6. Broder

Stout (1953)

- Fungating
- Penetrating
- Superficial Spreading
- Linitis plastica

Borrmann's Classification according to macroscopic appearance:

1. Polypoid or Fungating
2. Ulcerating lesions surrounded by elevated borders

3. Ulcerated lesions infiltrating gastric wall
4. Diffusely infiltrating

Unclassified

Japanese Endoscopic Society Classification of EGC

- Type I – Protruding
- Type II – Superficial
  - II a – elevated
  - II b – flat
  - II c – depressed
- Type III - Excavated

Ming classification (1977)

- Expansive
  - Polypoid
  - Superficial
  - Good prognosis
- Infiltrating
  - Diffuse
  - Poor prognosis

Gastric cancer is classified into early gastric cancer and advanced gastric cancer depending upon the depth of invasion of wall of the stomach with the help of endoscopic Ultrasonography.

Early gastric cancer is defined as cancer limited to mucosa and submucosa with or without lymph node involvement. *Advanced gastric cancer* involves the muscularis mucosa and serosa involving adjancent structures and distant spread.

Lauren (DIO) Classification (1965) (Most widely used)

- A diffuse (D) type (type 2), with poorly cohesive cells that tend to infiltrate the gastric wall. Tumors of this type may involve any part of the stomach, especially the cardia, and have a worse prognosis than the intestinal type. Unlike type 1 gastric cancers, type 2 cancers have similar frequencies in all geographic areas. Genetic predisposition present. Occurs commonly in young and middle aged persons. No precancerous states have been noted.
- Intestinal (I) type (type 1), with well-formed glandular structures and a circumscribed lesion: This type is more likely to involve the distal stomach and occur in older patients with atrophic gastritis. It has a strong environmental association. Precancerous states are present. It has a better prognosis.

Others (O): 14 to 16% Mixed

Broder histological classification

1. Well differentiated
2. Moderately differentiated

3. Poorly differentiated
4. Undifferentiated

Microscopically, the major histological types of gastric malignancy are

1. Adenocarcinoma- which accounts for 95% of malignant tumours of the stomach. It has been histologically subclassified as papillary, tubular, mucinous and signet ring type.

2. Leiomyosarcoma.
3. Lymphoma
4. Carcinoid
5. Squamous cell carcinoma.

Very rarely alpha feto protein producing carcinoma, chorio carcinoma, neurogenic and vascular tumours can occur. At times there may be some difficulty in differentiating a lymphoma from poorly differentiating adenocarcinoma. Special stains and immuno histochemistry may be of value in these situations.

Youseke adachi adopted a new classification for carcinoma stomach as well-differentiated gastric cancer and poorly differentiated gastric cancer.

Well- differentiated gastric carcinoma includes

1. Papillary and tubular adenocarcinoma
2. Medullary carcinoma

3. Well- differentiated mucinous carcinoma

Poorly differentiated gastric carcinoma includes

1. Scirrous carcinoma
2. Signet ring cell carcinoma.
3. Poorly differentiated mucinous carcinoma.

The specific features are as follows:

Well differentiated carcinoma	Poorly differentiated carcinoma
Common in old age groups	Common in young age
Male Preponderance	Female preponderance
Small size tumour	Large tumor size
Polypoid lesion common	Ulcerative lesion common
Common in lower third lesion	Common in middle third lesion

SPREAD OF GASTRIC CARCINOMA

1.Direct spread: In the stomach wall the spread is usually upward along the lesser curvature towards the cardia. The growth spreads mainly in the sub mucous coat to the adjacent organs. Growth in the stomach may involve neighbouring viscera by direct spread.

2.Lymphatic spread- Lymphatic spread mainly occurs either by embolism or by permeation. Usually the nodes, which drain the particular area of the stomach, are first involved.

3. **Blood spread-** The veins of the stomach mainly drain into the portal vein into the liver. So liver is the most commonly affected organ through this spread.

4. **Trans peritoneal spread**- Malignant cells may gravitate to the pelvis and form pelvic deposits, which may be felt on rectal examination (Blumer's shelf sign). Bilateral ovarian tumors (Krukenberg's tumor) have also developed following gastric cancer in premenopausal women. On section these tumours show involvement of medulla and that is why retrograde lymphatic permeation has been more incriminated to be the cause of this tumor than transcoelomic implantation.

CLINICAL PRESENTATION OF CARCINOMA STOMACH

The symptoms are often vague, non-specific and attributed to non-specific dietary indigestion. By the time diagnosis is made, lesion is often incurable or non-resectable. This was illustrated by Theodor Storm's poem in 1888 describing his death from gastric carcinoma. Unfortunately this experience is still common in our place for more than 100 years. Definite symptoms do not usually

occur until the lesion is large enough to obstruct lumen or cause disordered gastric function by invading a large segment of wall or until it bleeds.

Over 70 % of patients have symptoms for more than 6 months prior to seeking advice – the most common being vague indigestion, upper abdominal pain, weight loss, nausea and vomiting, hemetemesis and malena, profound anorexia, early satiety and flatulence. The pain may mimic angina or behave like that of benign peptic ulcer disease showing periodicity. True postprandial pain in carcinoma stomach is unusual. Dysphagia is present in OG junction tumors, but more than 80% of lumen is obstructed by the time of presentation of dysphagia. Early gastric cancer produces dyspeptic like symptoms. The presence of epigastric mass indicates poor prognosis. Common symptoms presented by patients with cancer of the stomach according to the order of frequency are as follows.

1. Epigastric pain and indigestion
2. Loss of appetite
3. Loss of weight
4. Upper GI bleed in the form of haematemesis or melaena
5. Increased fatiguability
6. Vomiting
7. Abdominal mass
8. Dysphagia

Signs

1. Anaemia
2. Epigastric mass with or without features of gastric outlet obstruction (VGP +).
3. Hepatomegaly with or without Jaundice
4. Ascites
5. Sister Mary Joseph is a nurse at Mayo clinic who pointed out the presence of visible and palpable secondary deposit at the umbilicus (presenting as a nodule) in advanced Carcinoma stomach. This is due to the spread of malignant cells along the lymphatic surrounding the falciform ligament. Sister Joseph's nodule is present when the primary may be situated in ovary, stomach or colon. It indicates poor prognosis and the mean survival is 3.5 months after its detection.
6. About 10 % of cases present with palpable supraclavicular lymph nodes. Virchow's node is the node present in between the two heads of sternocleidomastoid – Troisier's sign.
7. Rectovesical pouch deposits (Blummer's shelf sign.
8. Krukenberg's tumour in premenopausal women.
9. Trousseau's sign is the presence of superficial thrombophlebitis of the legs which is present in malignancy of the stomach, pancreas. Unfortunately there is rarely any symptom that is attributable to the

existence of early carcinoma of the stomach. The features of advanced gastric cancer are usually obvious. In advanced gastric cancer, early satiety, bloating, distension and vomiting may occur particularly with gastric outlet obstruction due to growth. Growth occurring in the body of the stomach may be clinically silent or may produce vague symptoms such as anorexia or epigastric fullness.

STAGING

The stomach is divided into three equal parts U, M & L- upper, middle & lower third. These alphabets are used to indicate the tumour location in the order of involvement. AJCC – American Joint Committee on Cancer staging (TNM) is the one that is currently followed. P0 and H0 denote absence of peritoneal and hepatic metastasis respectively. CY1 indicates presence of cancer cells on peritoneal Cytology.

TNM STAGING

Primary tumour (T)

T_x - Primary tumour cannot be assessed

T_0 - No evidence of primary tumour

T_{is} - Carcinoma in situ (intra epithelial tumour without invasion of lamina propria)

T_1 - Tumour invades sub mucosa

T_2 - Tumour invades muscularis propria or subserosa

T_3 - Tumour penetrates serosa without invasion of adjacent structures

T_4 - Tumour invades adjacent structures

Regional lymph nodes (N)

N_X - Regional lymph nodes cannot be assessed

N_0 - No regional lymph node metastasis

N_1 - Metastasis to 1to 6 regional lymph nodes

N_2 - Metastasis to 7 to 15 regional lymph nodes

N_3 - Metastasis to more than 15 regional lymph nodes

Distant metastasis (M)

M_X - Distant metastasis cannot be assessed

M_0 - No distant metastasis

M_1 - Distant metastasis

Staging and 5-Year Survival Rates

Stage	TNM Stage	5YSR
0	T_{is} N_0 M_0	90 %

I A I B	T_1 N_0 M_0 T_1 N_1 M_0 T_2 N_0 M_0	88 %
II	T_1 N_2 M_0 T_2 N_1 M_0 T_3 N_0 M_0	65%
III A	T_2 N_2 M_0 T_3 N_1 M_0 T_4 N_0 M_0	35%
III B	T_3 N_2 M_0	35%
IV	T_4 N_1 M_0 T_4 N_2 M_0 any T N_3 M_0 any T any N M_1	5%

INVESTIGATIONS

1. Once gastric cancer is suspected based on history and physical examination, flexible upper GI endoscopy and biopsy is the diagnostic modality of choice. The accuracy of this test is 98%. The location, size, morphology of the tumour can be observed apart from other mucosal abnormalities. Differentiating feature of benign from malignant ulcer is that the mucosal folds converge radially towards the crater in benign ulcer whereas disruption of folds and blurring of the ulcer edge will be evident in malignant ulcer. At least 6 biopsies should be taken from the edge of

the ulcer from all the four quadrants avoiding the necrotic areas of the ulcer bed. The sensitivity of biopsy alone varies from 75-85%.

2. Once the diagnosis is confirmed, further studies include complete blood counts, biochemical analysis and urine analysis.
3. Liver function tests help in assessing the hepatic reserve.
4. ECG
5. Plain X-ray chest: Done in all patients to rule out pulmonary secondaries.
6. Plain X- ray abdomen may show
    - A mass projecting into the gas shadow of the stomach.
    - Separation of the gas shadow from diaphragm.
    - Absence of gas bubble.
7. Barium meal series:

Double-contrast barium upper GI examination is widely recognized as the radiologic technique of choice for diagnosing early gastric cancers.

Radiological signs of malignancy in Barium meal series:

- Small or large persistent irregular filling defect
- Absence of peristalsis movements from involved area of the wall.
- Pyloric obstruction with grossly distended stomach

- Linitis plastica, detected by small and rigid stomach that lacks mucosal folds (leather - bottle appearance) and peristalsis and empties rapidly.
- Infiltrating carcinomas result in irregular narrowing of the stomach, with nodularity or spiculation of the mucosa.

Equivocal lesions should always be confirmed or ruled out by means of endoscopy and biopsy.

8. Ultrasonogram Abdomen and pelvis:

It has an important role in the detection of site and extent of tumour, lymph nodal metastasis, ascites and liver metastasis and Krukenberg's tumor in females.

9. CT SCAN Abdomen (Plain & Contrast)

Determination of the extent of the disease may assist in making decisions regarding treatment. For this, all patients should undergo computed tomography scan after the diagnosis of gastric malignancy has been done. This can delineate extra gastric extension, accurate demonstration of nodal involvement (25-86% accuracy) liver metastasis and ascites. Thus CT scan can be used to avoid unnecessary surgery in patients with advanced gastric cancer. Limitation of CT scan is that less than 5mm metastasis can not be detected.

10. CT Chest – is done in proximal gastric cancers.

11. Endoscopic ultrasound:

Endoscopic ultrasound with specially constructed ultrasonic transducers attached at the end of an endoscope provides images of high resolution. This can now be used to stage carcinoma stomach accurately in early gastric cancer.

- Accurate assessment of depth of penetration of tumour is possible especially to differentiate early from advanced cancer.
- Extent of lymph node involvement can be assessed.
- Metastasis to left lobe of liver and contiguous structures can be assessed.

12. Staging Laparoscopy:

This technique can also be used in the assessment of patients with gastric Cancer. It is mainly used to detect the serosal and peritoneal involvement that is difficult to diagnose by other techniques. Cytological analysis of peritoneal fluid can reveal free intraperitoneal gastric cancer cells in patients with otherwise occult carcinomatous cells. Its main limitation is in the evaluation of posterior extension.

13. Laparoscopic ultrasonogram:

Laparoscopic ultra sonogram although more invasive than endoscopic Ultra sonogram shows promise in both identifying unsuspected metastasis to

liver or peritoneum and more accurately identifying the lymph node metastasis and T stage.

14. Tumour Markers:

With reference to tumour markers, no satisfactory specific marker is available presently. Foetal sialoglyconidase, CA 19-9, lactic dehydrogenase, B-Glucuronidase, ER receptors, cathepsin, etc., are under study.

TREATMENT OF CARCINOMA STOMACH

The primary modality of treatment with curative and palliative intent is surgery. Adjuvant chemotherapy has been found to be beneficial in only few patients. The word operable means the growth can be removed with a curative or palliative intent. Inoperable means there are no chances of cure.

AIM OF SURGERY

1. Radical curative resection should be done whenever possible.
2. By pass procedure to relieve vomiting in advanced cases.

3. Palliative gastrectomy can be done to remove a fungating, ulcerative or bleeding mass. It gives better palliation than other modalities of treatment.

Curative resection is possible only for the tumours limited to stomach and neighbouring lymph nodes, though the presence of fixity to surrounding structures can be removed enbloc with the primary tumour. A 5 – 6 cm margin of clearance is recommended. The most appropriate operation for a given patient with gastric carcinoma depends upon the location of lesion and known pattern of spread of lesion in that site. For these reasons, stomach is divided into 3 parts.

Proximal - extends from gastro esophageal junction to fundus.

Middle - body of the stomach, which extends from fundus to incisura angularis of lesser curvature.

Distal - extends from incisura angularis to pyloric sphincter.

PROXIMAL THIRD LESION

The proximal gastric cancer seems to affect principally higher socio economic groups. Lesion in this location can metastasize to all regional lymph nodes. Surgery done for such lesions is Total radical gastrectomy, with extended lymph node dissection. The extent of lymph nodes dissection depends upon the involvement of lymph nodes which are grouped as N_1, N_2, N_3.

D1 Resection-Total radical gastrectemy with removal of N_1 group of lymph nodes.

D2 Resection -Ttotal radical gastrectomy with removal of N_1, N_2 group of lymph nodes.

D3 resection - Total radical gastrectomy with removal of N_1, N_2, & para aortic group of lymph nodes.

The exact benefit of nodal dissection or the lack of benefit is still under evaluation. Probably ideal curative surgery is possible only in tumours where there is no serosal involvement with either N0 or N1 nodal disease. This is so because when there is disease on the serosal surface, peritoneal dissemination is a high possibility for which, however extensive the loco regional surgery is, will not be entirely adequate. Survival also drops with increasing involvement of higher nodal groups even if appropriate lymphadenectomy has been done. However Japanese still believe in extensive lymph node dissection and they proved improved survival rates following this approach. Tumours in the fundus of the stomach are managed by radical subtotal gastrectemy. In this surgery, the upper part of the stomach, lower end of esophagus, with regional Lymph nodes and spleen, are removed followed by oesophagogastric anastomosis or oesophagojejunal anastomosis.

MIDDLE THIRD LESION

Lesion in this location is usually asymptomatic until they become quite large, with metastasis to regional lymph nodes. Surgical options for middle third lesion depends upon whether tumour is located proximal or distal to Demels line.

Demels line passes from 5 cm below cardio oesophageal junction in the lesser curvature, to the transition zone between the vascular territories of Right and left gastro epiploic vessels on greater curvature. Total radical gastrectemy is done for tumours that are located proximal to Demels line. Distal Radical gastrectemy (Nyhus) with D2 lymph node dissection is done for tumours that are located distal to Demels line. In distal radical gastrectemy 80- 85% of the stomach is removed. Excision of the growth with a wide margin of the healthy tissue above and below the diseased area would also include,

1. Removal of the first portion of the duodenum
2. Removal of all but 1 to 2 cm of proximal portion of the lesser curvature of the stomach
3. Removal of at least 80 to 95% of the greater curvature of the stomach
4. Removal of all the regional lymph nodes such as suprapyloric, the retro pyloric and the infrapyloric, the nodes along the lesser curvature, the celiac axis and hepatic artery group of nodes, the paracardial nodes, the suprapancreatic nodes and those along the greater curvature, the right and left gastroepiploic lymph nodes.
5. Removal of the greater omentum and gastrohepatic omentum.
6. Removal of the spleen and tail of the pancreas in selected cases.

DISTAL THIRD LESIONS

These are diagnosed somewhat earlier than those located proximally, because they can cause obstructive symptoms even when relatively small. To achieve the goal of complete removal of primary tumour with minimum of 5 cm clearance, the preferred operation is distal radical gastrectomy with D2 lymph node dissection.

In Japan	5 YSR	Post op morbidity	Post op Mortality
D1 Resection	18%	28%	6.5%
D2 Resection	39%	46%	13%

In UK there was no survival benefit between D1 and D2 Resections.

DIFFUSE GROWTH

Radical total gastrectemy followed by oesophagojejunostomy is done for the diffuse tumours. After total gastrectomy either a loop jejunostomy with jejunojejunostomy or a Roux en Y is done. Splenectemy and distal pancreatectemy as a routine along with gastrectemy does not give better results. So whenever possible spleen & pancreas should be preserved.

SIGNS OF INOPERABLITY

1. Growth fixed to pancreas or posterior abdominal wall.
2. Secondaries in the liver, producing hard nodular liver.
3. Presence of Rectovesical pouch deposits
4. Enlarged, fixed celiac nodes, para aortic nodes and left supraclavicular nodes.

5. Krukenberg tumour.
6. Malignant ascites.
7. Sister Joseph nodule.

PALLIATIVE SURGERY

The goal of palliative treatment is to relieve symptoms with minimal morbidity. In many cases after exploration, the growth is not suitable for radical operations. In these cases palliative surgery is done depending upon the case.

Following are a few varieties of palliative surgeries available for gastric malignancy.

1. Palliative resection of growth- Whenever possible, if the malignant growth in the stomach can be resected together with the healthy margin of a gastric wall this should be undertaken. Thus, focal necrotic and sloughing mass of the tumour, which can produce toxemia and bleeding is removed.
2. Antral exclusion operation (Devine's procedure)

   For fixed adherent inoperable growth involving the antral or pyloric portion of the stomach, which defies resection, antral exclusion combined with Ante colic gastro jejunostomy is indicated. A pair of clamps is applied to the healthy portion of the stomach 5 cm proximal to the edge of the stomach. The stomach is transected and the distal end is securely closed and sealed off. A gastrojejunostomy is done by bringing the jejunum in front of

the transverse colon and anastomosed with the remaining portion of the stomach. The immediate results are good as appetite is restored and the patients return to work very soon.

3. Palliative Gastro jejunostomy

For inoperable malignant lesions of the antrum and pylorus associated with obstructive symptoms, anterior gastro jejunostomy is indicated.

4. Feeding Jejunostomy- When the cancer of the stomach invades the whole stomach wall, a feeding jejunostomy can be tried for palliation.
5. Feeding Gastrostomy - In case of inoperable cancer of the cardiac end of the stomach in which oesophago gastrostomy or oesophago jejunostomy is not feasible, feeding gastrostomy can be done.
6. Non operative therapies – Laser recanalisation and endoscopy dilatation with or without stent placement has been tried in advanced carcinoma with dysphagia. Laser cryocoagulation of identifiable bleeding points on the tumour can be done.

<u>Other treatment modalities available for early superficial cancer:</u>

Laparo endoluminal mucosectemy

It is a recent surgical approach for early gastric cancer. It consists of combined endoscopic and laparoscopic approach for mucosectemy. It is

particulary indicated in lesion confined to posterior wall of the stomach & fundus.

Trans gastrostomal endoscopic surgery

This approach is particularly useful for lesions in the posterior wall of the stomach. Technique involves small midiline incision through which anterior gastrostomy done and an endoscope is introduced through this opening. Both mucosectemy and full thickness resection is possible with this approach.

Laparoscopic surgery

1. **Laparoscopic wedge resection with lymphadenectemy**

   This procedure was introduced for small superficial lesion confined to anterior wall without significant submucosal invasion. After accurate localization of the lesions with intraoperative flexible Endoscope, wedge resection of the lesion is done.

2. **Laparoscopic D1 Gastrectomy**

   This was done for early gastric cancer in which the tumour size is less than 3 cm & when there is no significant sub mucosal invasion.

   D2 Gastrectomy has been performed laparoscopically, however the benefits are unclear.

CHEMOTHERAPY

The idea for adjuvant chemotherapy is to try and reduce the failure rate after adequate surgery. Postoperative adjuvant chemotherapy reduces the

recurrence rate and prolongs the survival to certain extent. Most commonly used chemotherapeutic regimen for carcinoma stomach is **FAM** regimen.

Drug	Dose	Days
5- **F**luorouracil	600mg/m^2	1
Adriamycin	30mg/m^2	1
Mitomycin	10mg/m^2	1

The above drugs are given for 6 cycles once in 21 days.

Currently the most effective regimen available for carcinoma stomach is **ECF** regime.

Epirubicin 50 mg/m^2 – three times weekly by bolus intravenously.

Cisplatinum 16mg/m^2 intravenously in 1L of normal saline.

5-**F**lurouracil 600mg/m^2 given by continuous infusion daily.

Other treatment regimes that are available for carcinoma stomach are

EFP (**E**toposide, 5- **F**luorouracil, Cis**p**latinum).

FAMeth (5- **F**lurouracil, **A**driamycin, **M**ethotrxate)

FAP (5- **F**lurouracil, **A**driamycin, **C**isplatin)

RADIATION THERAPY

Pre and postoperative external beam therapies offered no survival benefits. As 5 FU is a radiosensitizer, combination of radiation and 5 FU have been tried. There was reduction in the local recurrence rate but overall survival

benefit has not been fully established. There is a recent randomized study in which after gastric resection with curative intent postoperative combined radiation and chemotherapy improved disease free survival and overall survival. To improve disease free survival and overall survival, the dose delivery to the regional area following resection (the gastric bed) was subjected to intra operative radiotherapy. Abe has claimed survival advantage in Stages II, III, IV. A small-randomized trial at the National cancer institute, Delhi showed decrease in local recurrence without survival benefit. The results of the randomized trial by the cancer institute, Chennai to assess the effectiveness of intra operative radiotherapy is awaited. The survival for gastric cancer patients has remarkably improved in countries like Japan. This is because of early detection, extensive surgeries and adjuvant therapies. In India a general population based screening programme is unlikely to be cost- effective or cost beneficial, but identification and screening of high- risk categories will definitely pay in the longer run.

Control of Other Symptoms

Pain

The principles of treatment outlined in the World Health Organisation pain relief programme should be followed (WHO analgesic ladder). Coeliac axis block should be considered in patients with severe upper abdominal pain who are intolerant of, or have pain unresponsive to, other analgesic measures.

Anorexia and Cachexia

Corticosteroids or megestrol acetate should be considered for patients with advanced gastric cancer who are anorexic.

Nausea and Vomiting

Octreotide and corticosteroids should be considered to relieve symptoms of bowel obstruction caused by malignancy where interventional therapy is not possible or appropriate.

Anemia

Blood transfusion is recommended as the standard treatment for symptomatic anaemia. Erythropoietin use should be considered in accordance with agreed guidelines.

PROGNOSTIC FACTORS

In the absence of distant metastasis in organs like liver, peritoneum, the prognostic factors in the order of importance are:

1. *Age* – young age is a poor prognostic indicator because of the delay in diagnosis and diffuse type of cancer in this age group.

2. *Depth of invasion of the gastric wall* - Tumours confined to mucosa and sub mucosa have a better prognosis than the tumours involving the serosa.

3. *Staging of the tumour (TNM)* - Stage I & II gastric cancers have a five- year survival rate ranging from 70-100% whereas Stage IV tumours have a five-year survival rate of only 11%.
4. *Site of malignancy* – proximal lesions have poorer prognosis.
5. *Tumor margins* - Diffuse infiltration of tumor margin and positive margins for malignant cells in the resected specimen have poor prognosis compared to expanding and pushing type of margins.
6. *Histological type* - Intestinal type of gastric cancer has a better prognosis than diffuse type.
7. *Tumor size* : Tumour size of less than 2 cm has a better prognosis with a five-year survival of 85% and tumour of more than 4 cm has a poor prognosis.
8. *Inflammatory reaction* at the interface between tumor and normal tissue associated with degenerative changes shows good prognosis.
9. Presence of *perineural invasion* indicates poor prognosis.
10. *Regional Lymph nodal status*
    i. In pathologically node negative patients, the 5 YSR is 50 %
    ii. In pathologically node positive patients, the 5 YSR is < 10 %
11. *Type of surgery* - Following D2 resection, the 5 YSR is 22 %
12. *Genetic Analysis* :
    i. Increased DNA ploidy & cell proliferation
    ii. C-erb B-2 protein overexpression

iii. P53 protein overexpression
iv. Increased level of cathepsin D , B & L
v. P27 kip 1 expression
vi. T- Antigen expression

All these have a poor prognosis.

FOLLOW UP

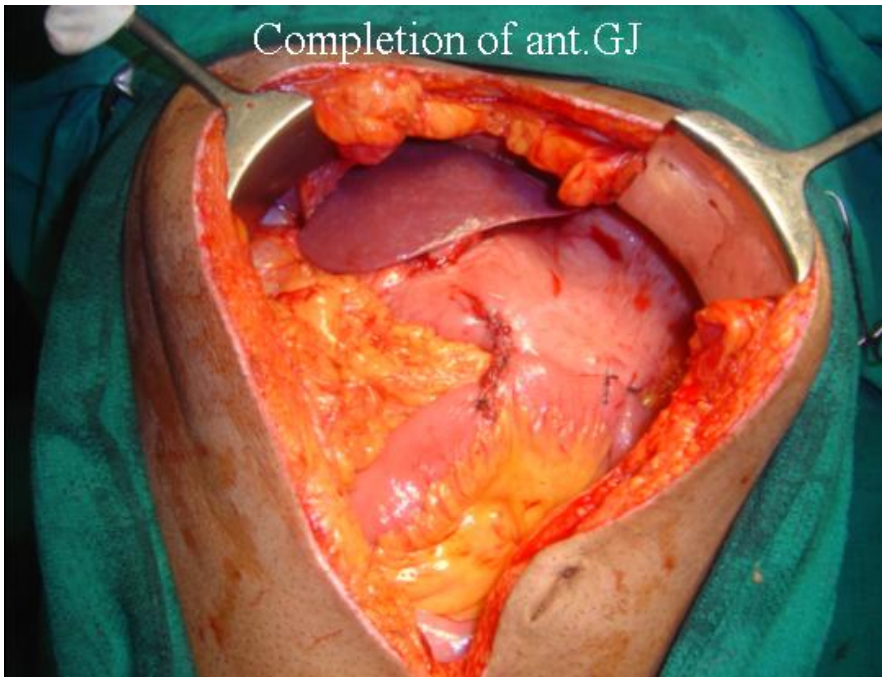
Postoperative follow up is aimed at detection of recurrent tumours and survival rate. As 80% of recurrences become apparent within three years of surgery, follow up should be intense during this period. Recurrences are common in the stomach bed. Surveillance should be done every 4 months for the 1st year and every 6 months for the 2nd year and then annually with history, physical examination, Complete Blood count, Liver function tests, Chest X-ray and yearly endoscopy.

CONCLUSION

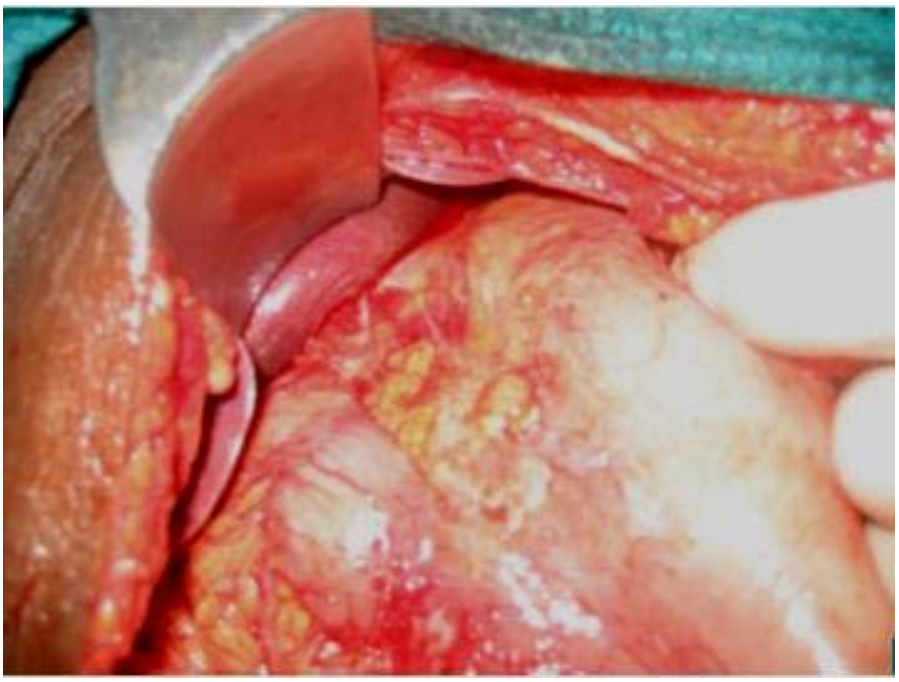
The peak incidence of carcinoma in our region is in fifth to sixth decade. According to western study reports, the peak incidence of gastric cancer is in the seventh decade. Our study revealed a male preponderance with a male to female ratio of 2.3:1. Smoking and alcoholism has a definite role in etiology of carcinoma of stomach. In contrast to increasing incidence of proximal gastric cancer as reported from western countries the majority of lesions studied in Madurai were found to be Antrum (distal gastric cancer) which is similar to the incidence reported from Japan. The most common macroscopic type of carcinoma in our region is protruding type next to which is ulcerative type. Endoscopy and Barium meal study are complementary to each other and have 90% accuracy in the diagnosis of gastric cancer. Histopathologically 73% cases were found to be poorly differentiated adenocarcinomas and about 20% of cases were found to be moderately differentiated adenocarcinomas and about 6% of

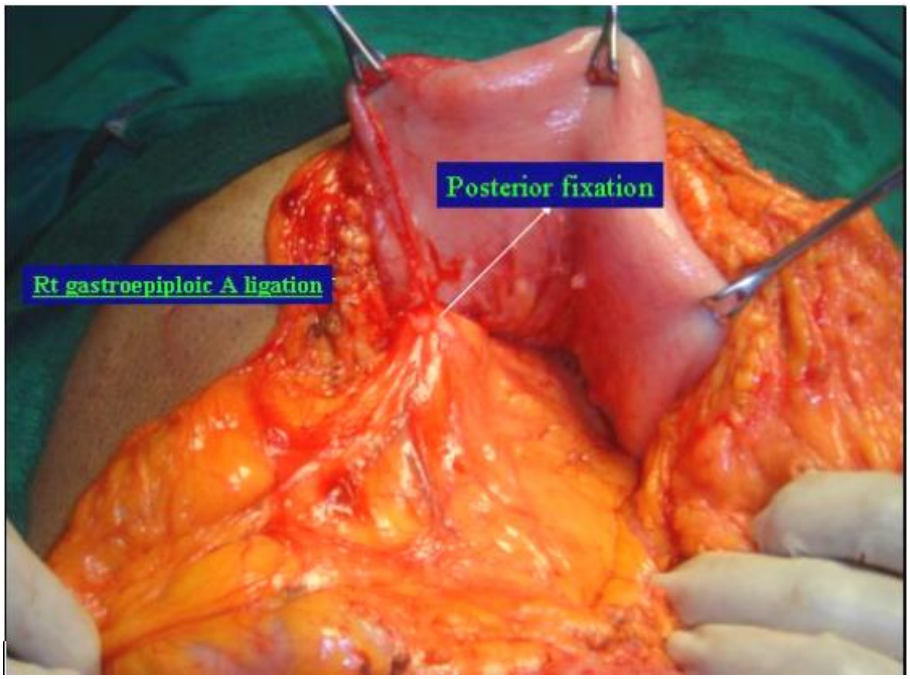
cases were well differentiated ones. One case was found to be Lymphoma of stomach. Most of the patients present in late stage and hence survival rate is decreased. Hence early diagnosis and radical resection are necessary to achieve better results.


Palliative ant.GJ

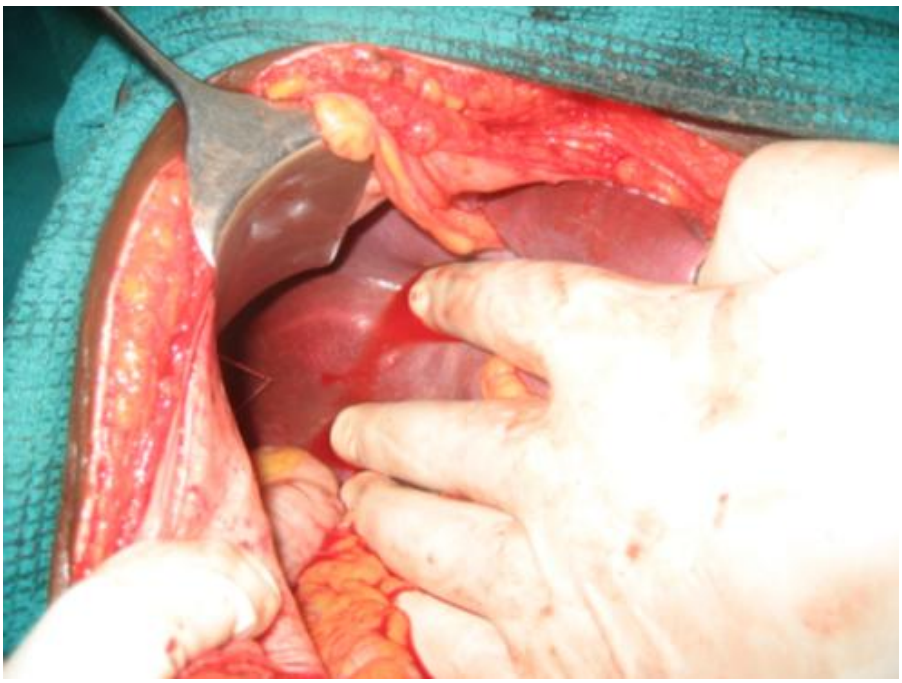

Completion of ant.GJ

SEROSAL INVOLVEMENT IN ADVANCED CARCINOMA STOMACH

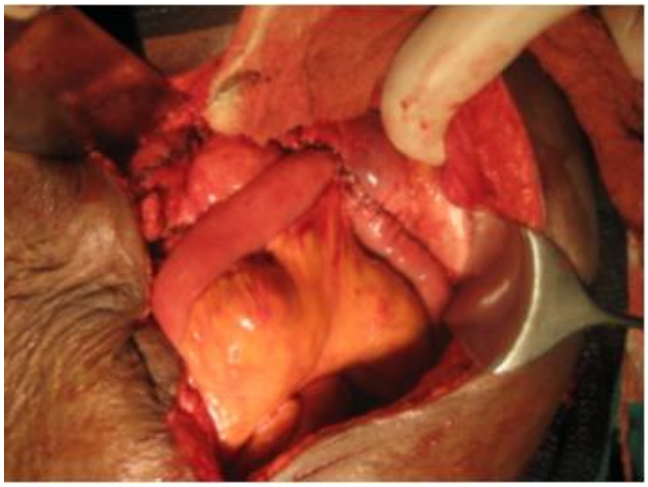



Posterior fixation
Rt gastroepiploic A ligation

LIVER SECONDARIES



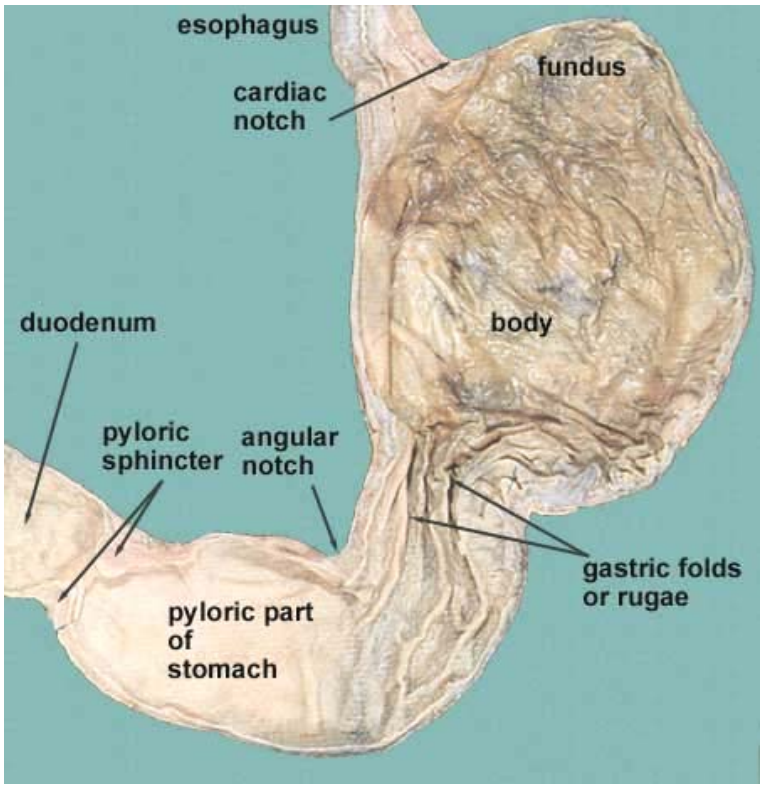
DISTAL SUBTOTAL GASTRECTOMY WITH GASTROJEJUNAL ANASTOMOSIS

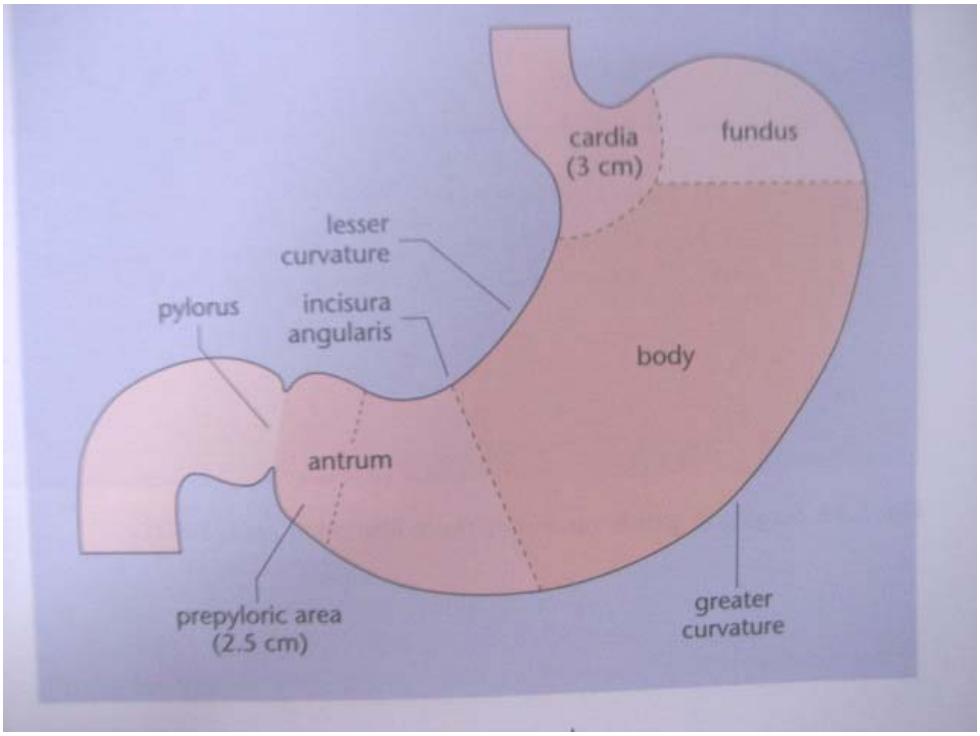


RESECTED SPECIMEN

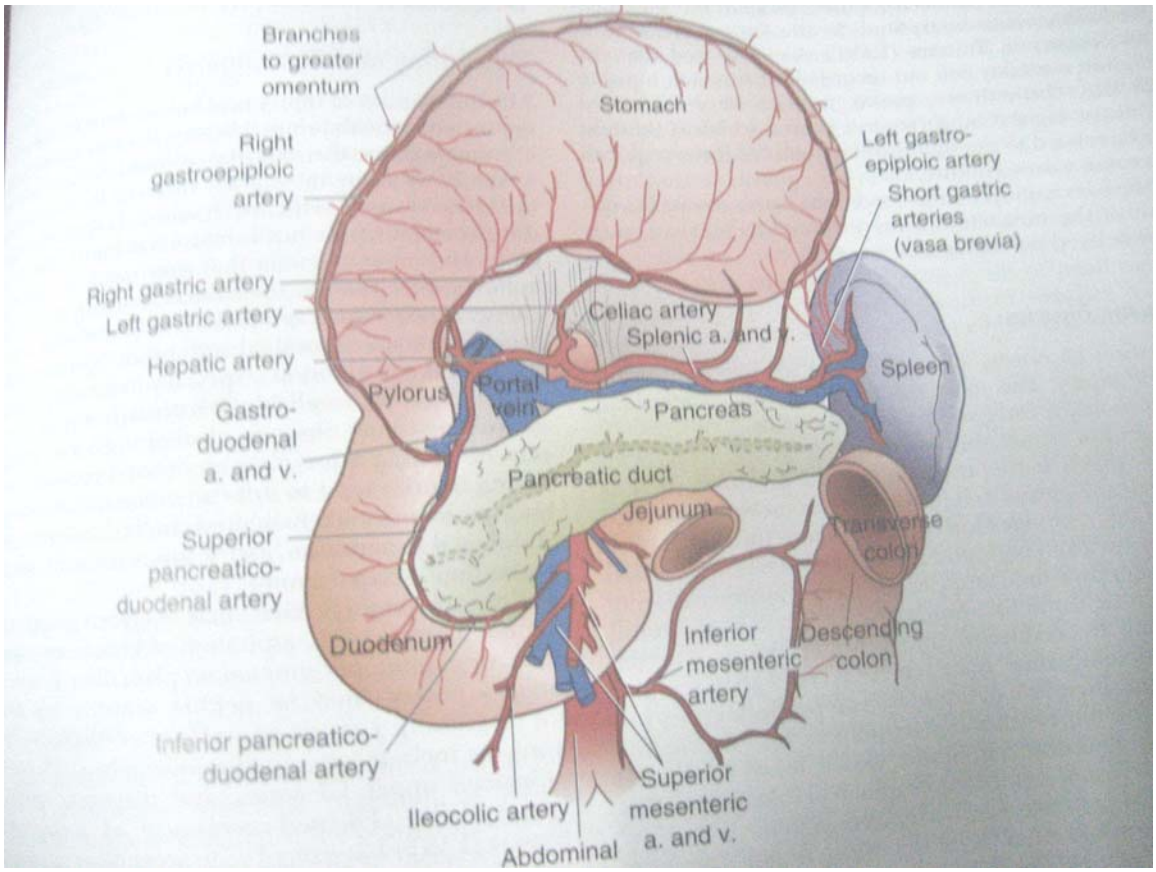
CUT SECTION OF THE SPECIMEN

PARTS OF THE STOMACH

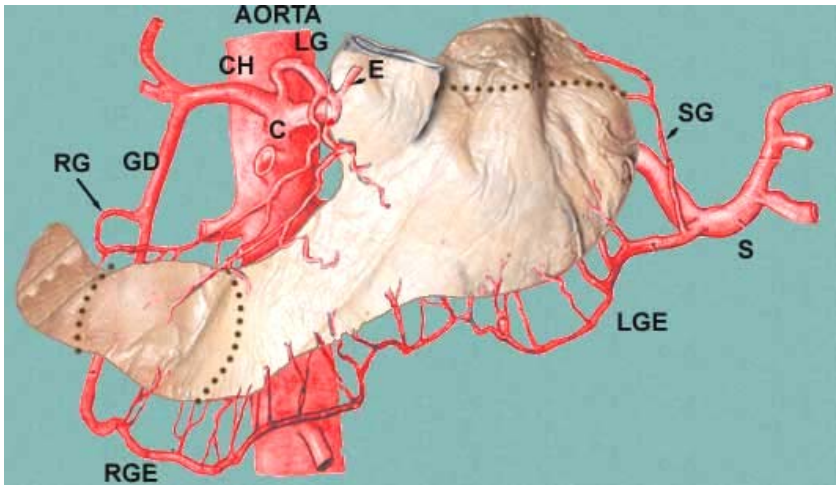




STOMACH BED

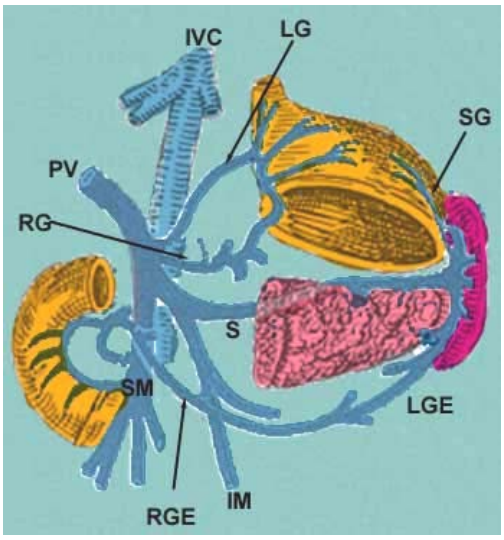

Branches to greater omentum
Stomach
Right gastroepiploic artery
Left gastro-epiploic artery
Short gastric arteries (vasa brevia)
Right gastric artery
Left gastric artery
Celiac artery
Splenic a. and v.
Hepatic artery
Spleen
Pylorus
Portal vein
Pancreas
Gastro-duodenal a. and v.
Pancreatic duct
Jejunum
Transverse colon
Superior pancreatico-duodenal artery
Duodenum
Inferior mesenteric artery
Descending colon
Inferior pancreatico-duodenal artery
Superior mesenteric a. and v.
Ileocolic artery
Abdominal

ARTERIAL SUPPLY OF THE STOMACH



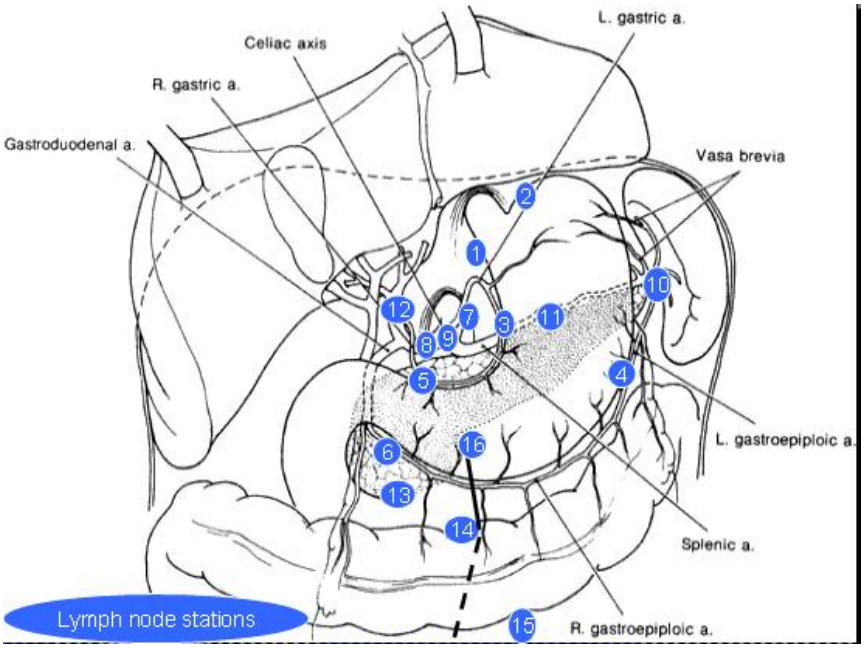
C - Celiac Artery
CH – Common Hepatic Artery
LG – Left Gastric Artery
GD – Gastroduodenal trunk
RG – Right Gastric Artery
LGE – Left Gastroepiploic artery
RGE – Right Gastroepiploic artery
SG – Short Gastric Artery
S- Splenic artery
E- Esophagus

VENOUS DRAINAGE OF THE STOMACH



LG – Left Gastric Vein
SG – Short Gastric Vein
PV – Portal vein
RG – Right Gastric Vein
IVC – Inferior Vena cava
IM – Inferior Mesentric Vein
SM – Superior Mesentric Vein
S - Splenic Vein
RGE – Right Gastroepiploic vein
LGE – Left Gastroepiploic vein

LYMPHATIC DRAINAGE OF THE STOMACH



1.Right paracardiac

2.Left paracardiac

3. Lesser curvature

4. Greater curvature

5. Supra pyloric

6. Sub pyloric

7. Left gastric

8. Common hepatic

9. Celiac

10.Nodes along the splenic hilum

11. Nodes along the splenic artery

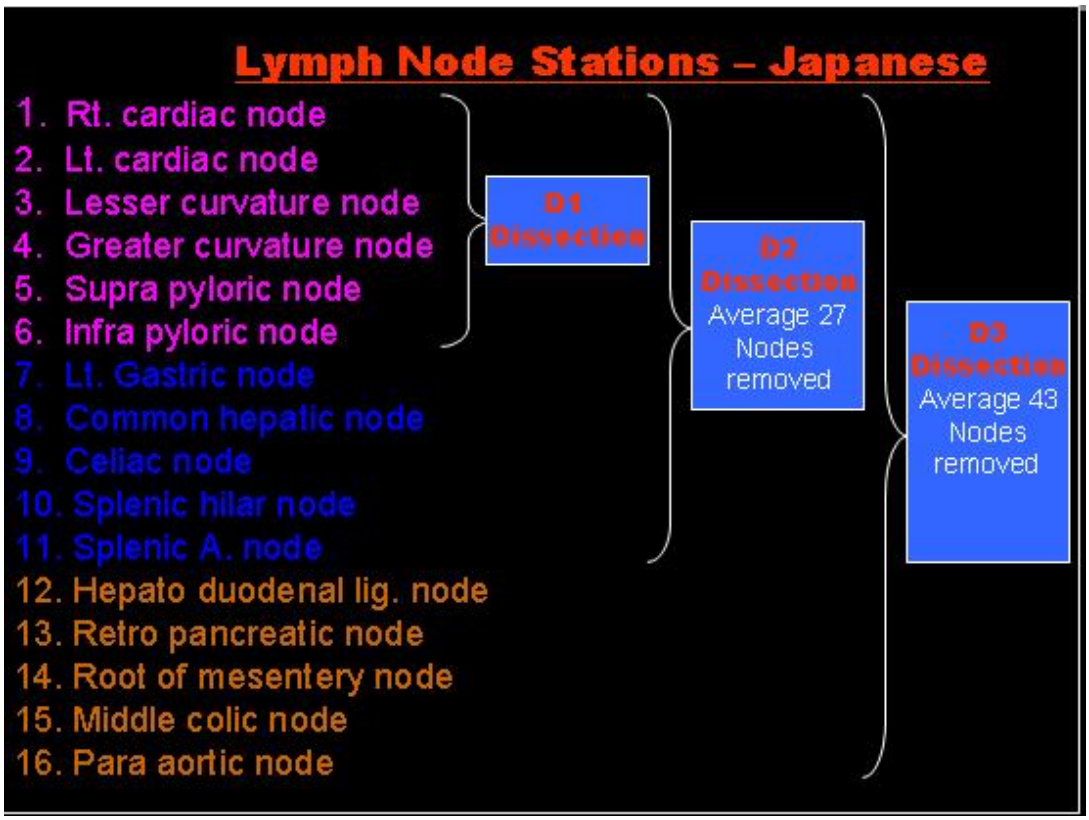
12. Nodes in lesser omentum

13. Retro pancreatic nodes

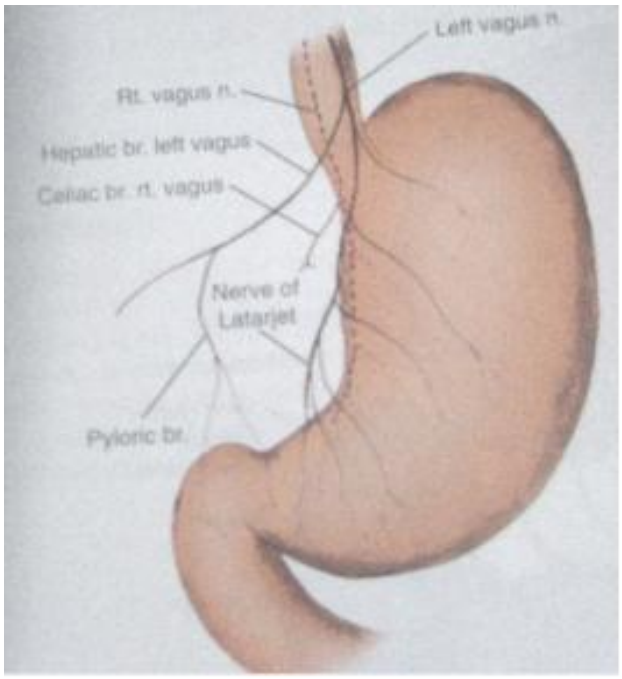
14. Nodes in bowel mesentry

15. Nodes along middle colic artery

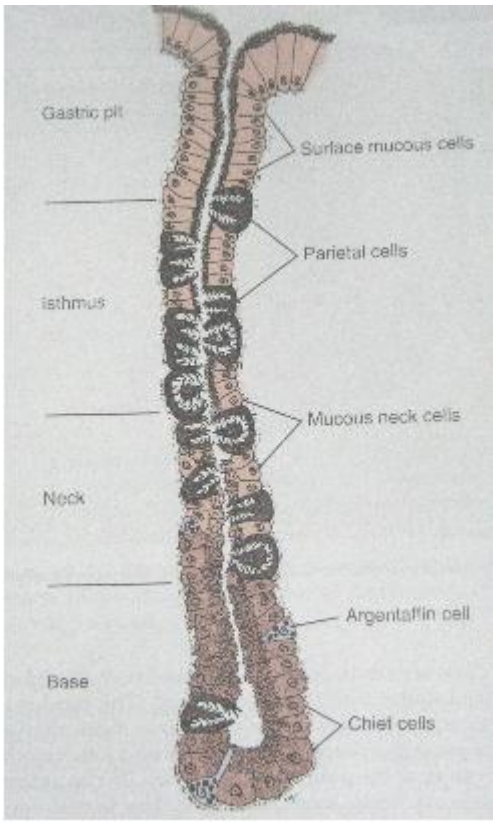
16. Para aortic nodes



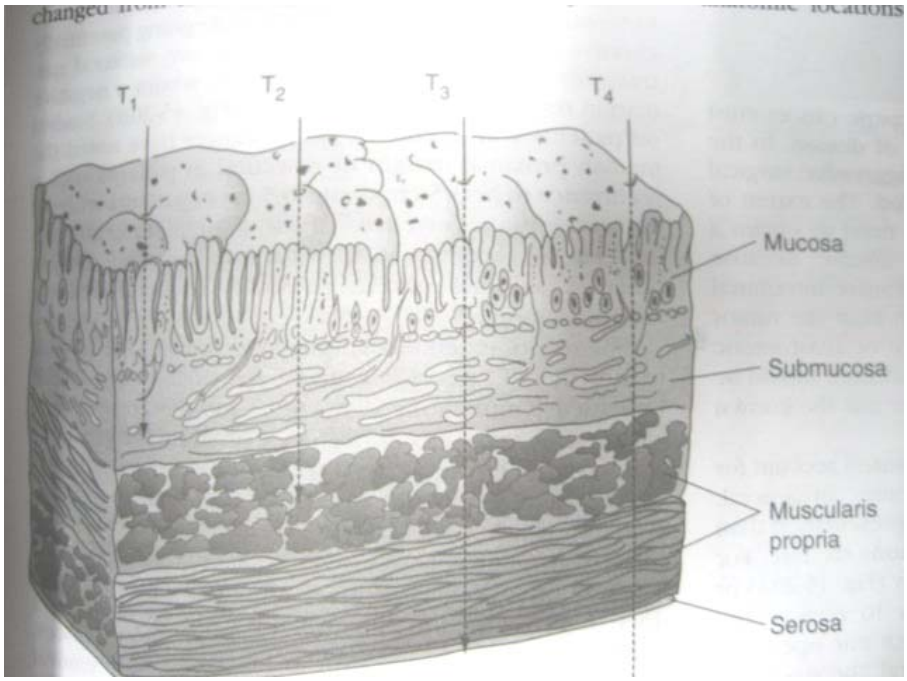
NERVE SUPPLY OF THE STOMACH


Left vagus n.
Rt. vagus n.
Hepatic br. left vagus
Celiac br. rt. vagus
Nerve of Latarjet
Pyloric br.

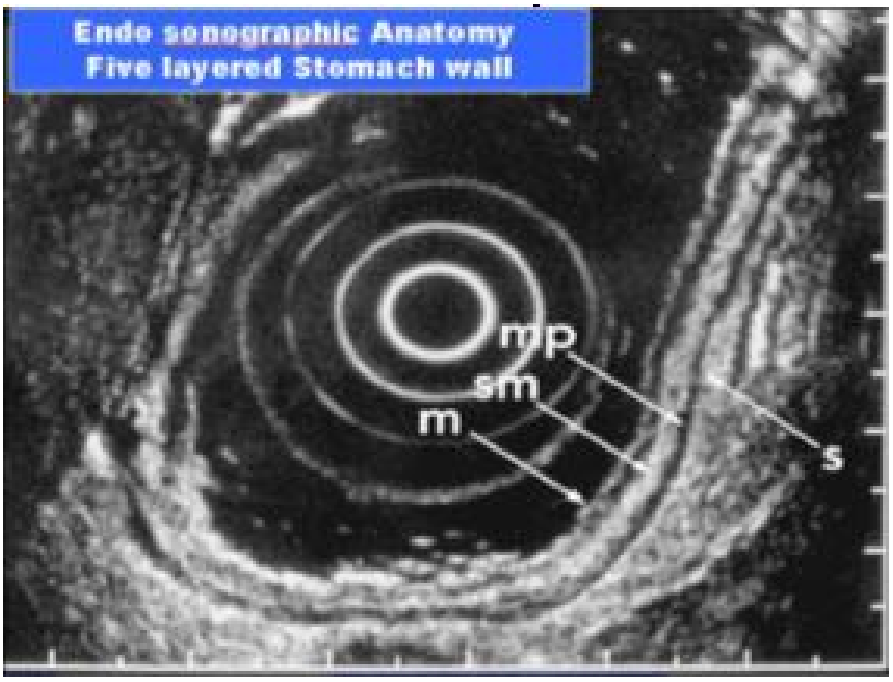
GASTRIC PIT

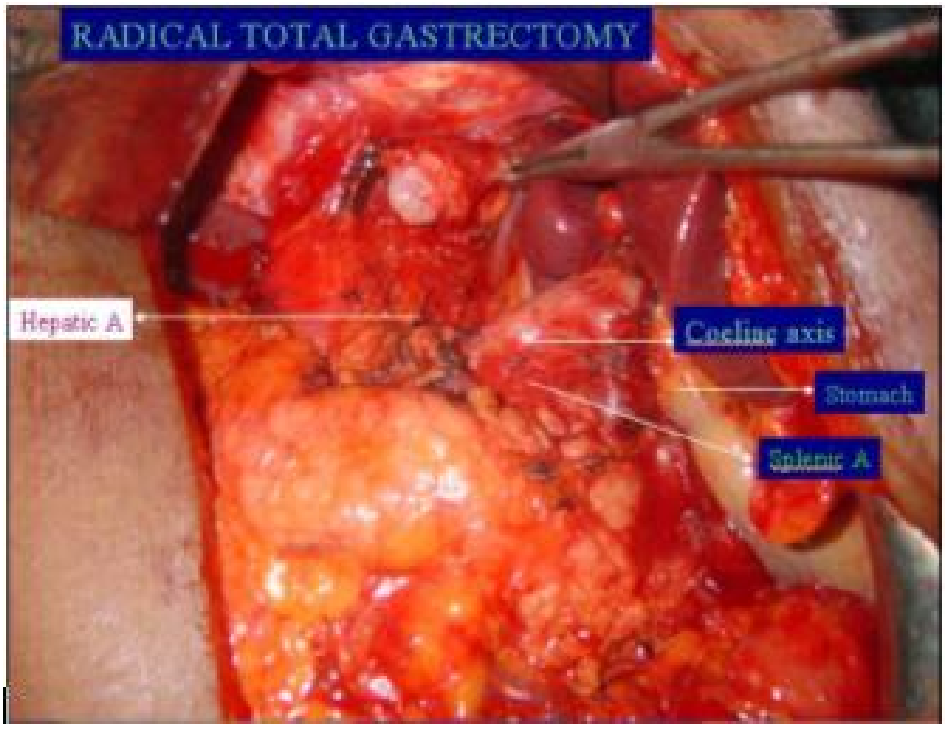

Gastric pit
Surface mucous cells
Parietal cells
Isthmus
Mucous neck cells
Neck
Argentaffin cell
Base
Chief cells

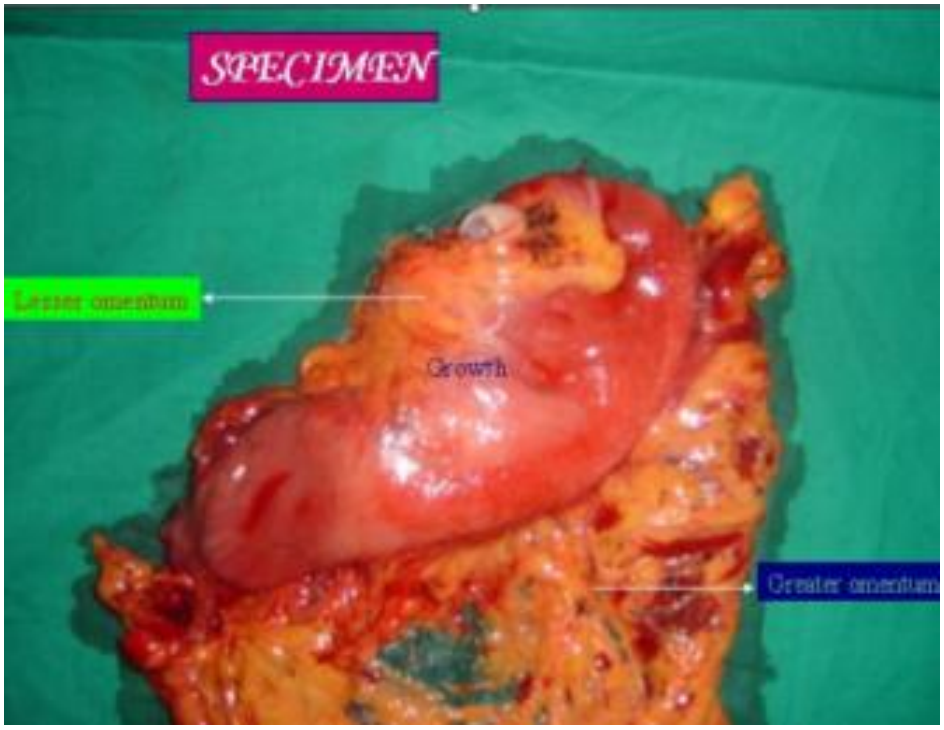
T. STAGING IN CARCINOMA STOMACH



ENDOSCOPIC ULTRASOUND


Endo sonographic Anatomy
Five layered Stomach wall
mp
sm
m
s


RADICAL TOTAL GASTRECTOMY
Hepatic A
Coeliac axis
Stomach
Splenic A


SPECIMEN
Lesser omentum
Growth
Greater omentum

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10. Robbins text book of pathology – 7th edition
11. Text book of surgery by S.Das 3rd Edition

MASTER CHART

S. No	Name	Age	Sex	IP.No	Site of Malignancy
1	Malarvizhi	34	F	355826	Distal
2	Nagarajan	38	M	355810	Distal
3	Avudaiyammal	60	F	364832	Distal
4	Pannerselvam	37	M	364817	Proximal
5	Santhalakshmi	37	F	363911	Distal
6	Sree Rangam	30	F	367982	Distal
7	Murugesan	55	M	367298	Proximal
8	Markandeyan	65	M	378112	Distal
9	Santhanam	65	M	378633	Proximal
10	Rajendran	54	M	345259	Distal
11	Muthiah	65	M	402702	Proximal
12	Gnanatheri	40	M	404382	Proximal
13	Baskaran	39	M	402235	Distal
14	Sathiah	55	M	410527	Distal
15	Anganan	55	M	411429	Proximal
16	Chellammal	65	F	411785	Proximal
17	Susai Manickam	64	M	412391	Proximal
18	Raju	49	M	80/06	Distal
19	Chidambaram	50	M	421443	Proximal
20	Karuppiah	48	M	430466	Distal
21	Muthupillai	63	M	429415	Distal
22	Neelakandan	53	M	440823	Distal
23	Seeniammal	68	F	439673	Distal
24	Ramasamy	50	M	448244	Distal
25	Ramu	60	M	439037	Distal
26	Rajaram	53	M	450766	Distal
27	Sankarapandi	73	M	119576	Proximal
28	Manjula	25	F	458156	Distal
29	Mayandi	65	M	458179	Proximal
30	Periyakaruppan	58	M	2813	Distal
31	Vellaisamy	60	M	461853	Distal

32	Pitchiamuthu	70	M	463458	Distal
33	Thangam	58	M	462762	Distal
34	Govindan	55	M	ESI	Proximal
35	Balaiah	54	M	464375	Distal
36	Krishnasamy	54	M	465655	Proximal
37	Ramachandran	62	M	468185	Distal
38	Rengasamy	60	M	469738	Proximal
39	Rajammal	54	F	164522	Distal
40	Rajendran	45	M	429677	Middle
41	Panchavarnaperumal	60	M	472027	Distal
42	Pandiammal	30	F	477640	Proximal
43	Govindan	64	M	479343	Distal
44	Mayan	58	M	477102	Distal
45	Lakshman	43	M	480042	Distal
46	Alagiri	56	M	476705	Distal
47	Mariyayee	40	F	481379	Distal
48	Theresammal	65	F	481208	Distal
49	Sethupathi	54	M	481140	Proximal
50	Andi	58	M	481870	Distal
51	Murugan	35	M	481476	Distal
52	Marimuthu	51	M	485682	Distal
53	Pandiammal	40	F	481419	Distal
54	Thiagarajan	50	M	484613	Distal
55	Solaimalai	52	M	484514	Distal
56	Andisamy	45	M	480026	Middle
57	Saraswathi	38	F	485881	Distal
58	Palanisamy	40	M	485877	Distal
59	Subbuagh	58	M	485861	Distal
60	Saseetharan	54	M	486921	Distal
61	Pandi	59	M	486833	Distal
62	Meenakshi	48	F	487081	Distal
63	Kali	56	M	1085/06	Distal
64	Appadurai	44	M	489463	Proximal
65	Pandi	40	M	488738	Distal

66	Gurusamy	58	M	487783	Distal
67	Palaniammal	70	F	492471	Distal
68	Meechtchi	56	F	489637	Distal
69	Arumugam	56	M	48889	Distal
70	Gopal	55	M	467987	Distal
71	Pattan	62	M	486422	Proximal
72	Kadarkarai	60	M	492175	Distal
73	Kandasamy	65	M	492904	Distal
74	Panchhu	55	M	487998	Proximal
75	Podumponnu	45	F	498533	Distal
76	Jeyaveerapandian	40	M	494004	Distal
77	Sundarraj	40	M	495208	Distal
78	Nallammal	30	F	495289	Distal
79	Poovayee	45	F	492376	Proximal
80	Radhakrishnan	60	M	493887	Proximal
81	Parasuraman	30	M	498151	Distal
82	Veeraganesan	29	M	498487	Distal
83	Chinnadurai	60	M	501234	Distal
84	Petchiyammal	60	F	498832	Proximal
85	Kaliyammal	60	F	257207	Distal
86	Lakshmi	57	F	502332	Proximal
87	Sivanandi	60	M	502650	Distal
88	Chidambaram	60	M	503230	Distal
89	Sumathy	26	F	503018	Distal
90	Balamurugan	42	M	1352	Proximal
91	Sadaiappan	72	M	502566	Proximal
92	Rani	38	F	2762	Proximal
93	Rajaram	45	M	1579/07	Distal
94	Karuppayee	70	F	3642	Distal
95	Ramu	70	M	4545	Proximal
96	Mookiah	75	M	4716	Distal
97	Ramu	52	M	552/07	Distal
98	Ganapathy	32	F	12462	Distal
99	Muthusamy	67	M	16404	Distal
100	Maruthai	35	F	12660	Proximal

101	Meena	50	F	16580	Distal
102	Arumugam	65	M	18423	Distal
103	Guruvammal	42	F	12111	Proximal
104	Pappathy	75	F	6952	Proximal
105	Leelavathy	65	F	20464	Proximal
106	Rajammal	50	F	17837	Distal
107	Chinnakaruppan	60	M	19401	Distal
108	Gopalachettyier	60	M	20571	Distal
109	Mariammal	47	F	21076	Distal
110	Valli	35	F	19231	Distal
111	Veerayee	60	F	21040	Distal
112	Rajaram	55	F	21760	Distal
113	Srinivasan	53	M	22435	Distal
114	Jai Alaudin	57	M	19514	Distal
115	Ramamoothry	62	M	23340	Distal
116	Valavanthal	36	M	20081	Distal
117	Indirani	52	F	24961	Proximal
118	Arumugam	50	F	25239	Distal
119	Ramanathan	55	M	22384	Distal
120	Vellaisamy	45	M	31221	Proximal
121	Sankarapandi	65	M	30937	Distal
122	Lakshmi	55	M	30853	Distal
123	Md Ali	50	F	502501	Distal
124	Murugeswari	72	M	502046	Distal
125	Muthiah	30	F	3162	Proximal
126	Natchathiram	60	M	4159	Distal
127	Balusamy	75	F	5968	Distal
128	Chelliah	71	M	6590	Distal
129	Govindtha	42	M	8173	Proximal
130	Govinthn	60	M	9136	Proximal
131	Kasim	55	M	11671	Distal
132	Rajamani	55	M	12703	Distal
133	Saroja	60	F	12380	Proximal
134	Karuppiah	65	M	12484	Distal
135	Manoharan	46	M	13382	Proximal
136	Kusalambal	42	F	12111	Proximal
137	Marudhan	56	M	12330	Distal
138	Kamatchi	55	F	13831	Distal
139	Sethu	45	M	15330	Proximal

140	Lakshmi	37	F	15679	Proximal
141	Gurusamy	50	M	15973	Proximal
142	Meenctchi	65	F	17933	Distal
143	Mariammal	60	F	17387	Proximal
144	Chelliah	63	M	17116	Proximal
145	Alimia	46	F	19814	Proximal
146	Gunasekaran	50	M	19882	Proximal
147	Chinnu	78	M	26100	Distal
148	Pandi	60	M	325567	Proximal
149	Krishnan	68	M	33660	Proximal
150	Mayathevar	70	M	360250	Distal
151	Neelangan	50	M	360273	Proximal
152	Shanmugasundaram	54	M	361574	Distal
153	Vatsala	53	F	363645	Proximal
154	Panchvarnam	55	F	360634	Distal
155	Dharman	50	M	361912	Middle
156	Muthulakshmi	50	F	361781	Proximal
157	Anusya	55	F	364640	Distal
158	Velu	50	M	361691	Proximal
159	Ganesan	65	M	304732	Middle
160	Shanmugasundaram	54	M	361574	Distal
161	Murugan	55	M	367298	Proximal
162	Pandiammal	30	F	397366	Distal
163	Nagammal	60	F	367859	Proximal
164	Ramuthiah	65	F	368748	Proximal
165	Karuppiah	50	M	369720	Distal
166	Periyasamy	60	M	369427	Proximal
167	Selvrani	32	F	369300	Proximal
168	Ponnusamy	74	M	371754	Distal
169	Parvathy	55	F	371521	Proximal
170	Ranchitham	70	F	371556	Distal

171	Shanthi	50	F	379805	Distal
172	Kamal batcha	54	F	372498	Middle
173	Andi	52	M	373263	Proximal
174	Mana	55	M	372348	Distal
175	Rajeswari	55	F	372520	Distal
176	Krishnan	55	M	373760	Middle
177	Arokia mary	50	F	376039	Proximal
178	Sudharshan	52	M	357310	Distal
179	Yagappan	47	M	376091	Distal
180	Santhanam	45	M	378633	Proximal
181	Rajamani	40	M	378756	Proximal
182	Ramasamy	67	M	379496	Distal
183	Hajina Bibi	50	F	382257	Proximal
184	Utaiyakal	48	M	384195	Proximal
185	Karuppiah	60	M	386429	Proximal
186	Karuppanan	70	M	391680	Distal
187	Maniappan	50	M	392390	Proximal
188	Thirunagulingam	45	M	392166	Distal
189	Krishnammal	47	F	392224	Proximal
190	Nagaraj	45	M	391948	Middle
191	Karisalingam	52	M	393020	Proximal
192	Ayyavoo	60	M	393384	Distal
193	Thirumaniammal	60	F	393966	Proximal
194	Kaliappan	70	M	394806	Distal
195	Subbammal	60	F	394674	Middle
196	Dhanam	78	M	395671	Distal
197	Udayan	40	M	395768	Distal
198	Pown Roja	23	F	387128	Distal
199	Siranjothi	28	F	398947	Proximal
200	Maheswari	38	F	398545	Whole
201	Pandian	55	M	395400	Distal
202	Shankar	65	M	399549	Proximal
203	Surentranath	66	M	39992	Whole
204	Karruppasamy	50	M	40008	Middle
205	Murugesan	45	M	400720	Proximal
206	Narayanasamy	50	M	401915	Distal

207	Murugan	36	M	402292	Proximal
208	Moovarasu	50	M	403932	Proximal
209	Baskaran	35	M	404235	Distal
210	Balu	70	M	404630	Proximal
211	Muniyandi	56	M	404439	Distal
212	Sevagan	40	M	407038	Distal
213	Arumugam	39	M	404826	Distal
214	Kamaraj	30	M	400425	Proximal
215	Chellammal	65	F	407844	Proximal
216	Rajammal	65	F	408209	Middle
217	Baskaran	39	M	404235	Middle
218	Ponniah	54	M	408743	Distal
219	Sethuraj	55	M	410527	Middle
220	Balusamy	40	M	410570	Proximal
221	Nagararajan	42	M	412255	Proximal
222	Rajeswari	57	F	412160	Middle
223	Susaimanicham,	64	M	412391	Proximal
224	Saravararaj	31	M	412962	Distal
225	Veeranan	55	M	413347	Distal
226	Abdul Razaak	45	M	418703	Proximal
227	Perumal	45	M	420718	Middle
228	Balakrishnan	62	M	420432	Distal
229	Krishnan	60	M	421067	Distal
230	Rasu	55	M	421125	Proximal
231	Mani	57	M	425881	Proximal
232	Sathya Moorthy	70	M	425849	Proximal
233	Raman	66	M	429018	Proximal
234	Amina	60	F	433730	Distal
235	Rajendran	45	M	499677	Whole
236	Janaki	41	F	434027	Distal
237	Otchammal	65	F	434451	Middle
238	Isakkiyammal	65	F	434789	Distal
239	Susila	21	F	434922	Distal
240	Muthukrishnan	60	M	435922	Distal
241	Perumal	54	M	435295	Distal
242	Muthukani	55	F	436273	Distal
243	Balakrishnan	48	M	436361	Distal

244	Kannappan	65	M	438122	Proximal
245	Meenatchisundaram	56	M	438358	Distal
246	Chellammal	27	F	440503	Proximal
247	Shanmugavalli	35	F	441905	Distal
248	Muniyappan	46	M	441673	Distal
249	Ramu	59	M	442207	Distal
250	Ramakrishnan	62	M	442131	Distal
251	Rajalakshmi	67	M	442651	Distal
252	Sarangan	40	M	442586	Distal
253	Ayyammal	65	F	443275	Distal
254	Muniasamy	60	M	443416	Distal
255	Velusamy	65	M	444344	Distal
256	Andi	45	M	444836	Distal
257	Alagi	65	F	447905	Distal
258	Khan Mohammed	60	M	445242	Distal
259	Subbiah	60	M	447650	Whole
260	Veerayee	55	F	448969	Distal
261	Madhavan	46	M	448572	Distal
262	Guruvammal	50	F	448757	Distal
263	Angusamy	45	M	45028	Distal
264	Mookhan	54	M	450912	Proximal
265	Subramani	45	M	450529	Proximal
266	Periyasamy	45	M	450728	Distal
267	Mariappan	60	M	451564	Distal
268	Adaikkalam	40	F	457937	Distal
269	Seetha Lakshmi	62	F	458812	Proximal
270	Perumayee	67	F	459379	Proximal
271	Poornam	45	F	460681	Distal
272	Karuppiah	70	M	460775	Distal
273	Palanisamy	45	M	461550	Distal
274	Subramanian	46	M	462026	Proximal
275	Alagumalai	65	M	462891	Distal
276	Ayyasamy	65	M	464170	Distal
277	Malaisamy	59	M	464034	Distal
278	Sheik Mohammed	70	M	464897	Distal
279	Muthammal	40	F	465321	Proximal

280	Singaraj	40	M	465215	Distal
281	Kamalam	60	F	465815	Proximal
282	Lakshmanan	36	M	465791	Distal
283	Kandasamy	66	M	466733	Distal
284	Syed Mehaboob	65	M	466696	Distal
285	Gopal	55	M	467571	Distal
286	Poosakalai	45	M	468844	Proximal
287	Unnasi	55	M	469213	Proximal
288	Panjavarna perumal	60	M	472027	Distal
289	Varusai Mohammed	55	M	471902	Distal
290	Palani	57	M	472729	Distal
291	Sonai	60	M	475351	Distal
292	Subbiah	54	M	476034	Proximal
293	Govindaraj	60	M	476021	Distal
294	Alagumalai	60	M	472552	Distal
295	Subburathinam	63	M	472470	Proximal
296	Shahul Hameed	36	M	476480	Distal
297	Vasantha	26	F	477977	Distal
298	Alagu	65	M	478477	Distal
299	Palanisamy	65	M	478343	Distal
300	Kuppammal	45	F	477424	Distal
301	Mayar	58	M	477102	Distal
302	Sulochana	65	F	488594	Proximal
303	Mohommed Ali	73	M	502046	Distal